

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

## Features

- **Temperature Ranges**
  - Commercial: 0°C to 70°C
  - Industrial: -40°C to 85°C
  - Automotive: -40°C to 125°C
- **High speed**
  - $t_{AA} = 12$  ns (Commercial & Industrial)
  - $t_{AA} = 15$  ns (Automotive)
- **CMOS for optimum speed/power**
- **Low active power**
  - 770 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 CY7C1021B is a high-performance CMOS static RAM organized as 65,536 words by 16 bits. This device has an

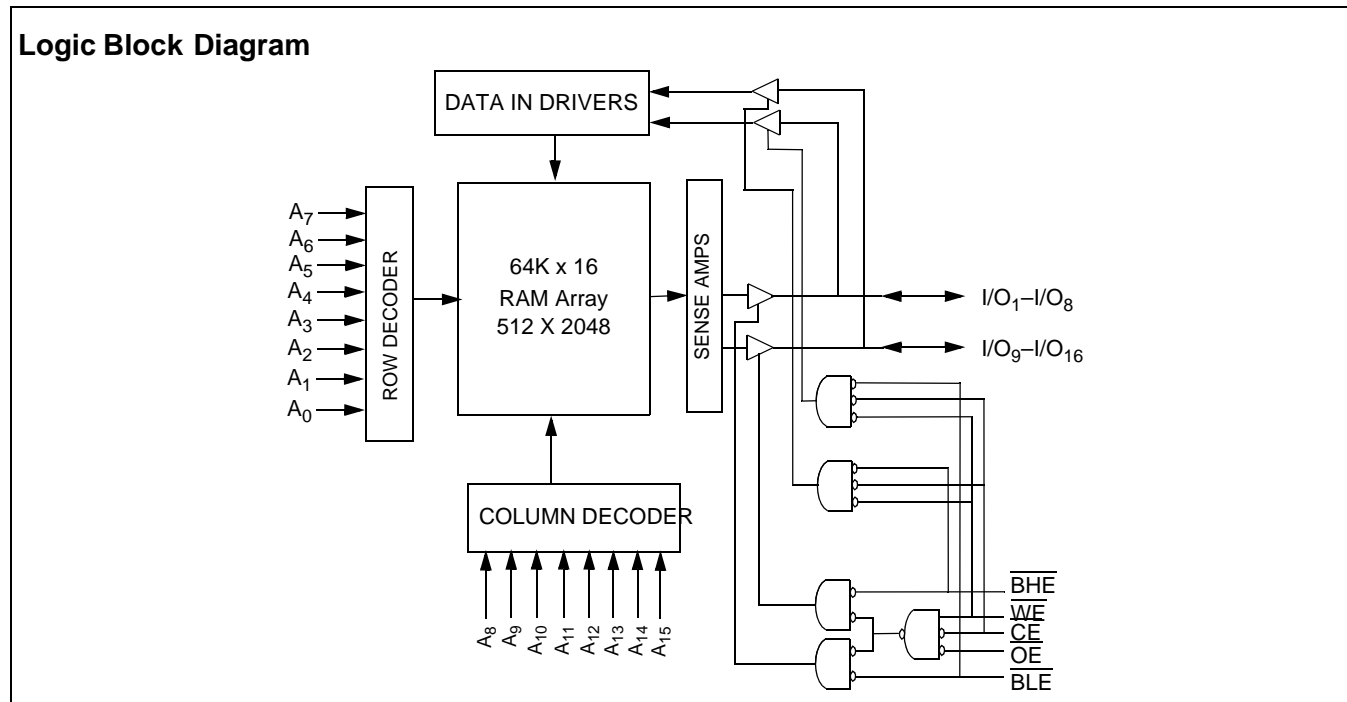
automatic power-down feature that significantly reduces power consumption when deselected.

Writing to the device is accomplished by taking Chip Enable ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs LOW. If Byte Low Enable ( $\overline{BLE}$ ) is LOW, then data from I/O pins ( $I/O_1$  through  $I/O_8$ ), is written into the location specified on the address pins ( $A_0$  through  $A_{15}$ ). If Byte High Enable ( $\overline{BHE}$ ) is LOW, then data from I/O pins ( $I/O_9$  through  $I/O_{16}$ ) is written into the location specified on the address pins ( $A_0$  through  $A_{15}$ ).

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  $I/O_1$  to  $I/O_8$ . If Byte High Enable ( $\overline{BHE}$ ) is LOW, then data from memory will appear on  $I/O_9$  to  $I/O_{16}$ . See the truth table at the back of this data sheet for a complete description of read and write modes.

The input/output pins ( $I/O_1$  through  $I/O_{16}$ ) 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 CY7C1021B is available in standard 44-pin TSOP Type II and 44-pin 400-mil-wide SOJ packages.

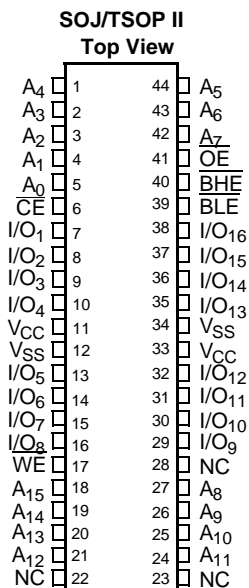


**Note:**

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

**Selection Guide**

		<b>-12</b>	<b>-15</b>
Maximum Access Time (ns)		12	15
Maximum Operating Current (mA)	Com'l/Ind'l	140	130
	Automotive		130
Maximum CMOS Standby Current (mA)	Com'l/Ind'l	10	10
	Automotive		15
	L Version	0.5	0.5

**Pin Configurations**

**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.
$\overline{\text{WE}}$	17	Input/Control	<b>Write Enable Input, active LOW.</b> When selected LOW, a Write is conducted. When deselected HIGH, a Read is conducted.
$\overline{\text{CE}}$	6	Input/Control	<b>Chip Enable Input, active LOW.</b> When LOW, selects the chip. When HIGH, deselects the chip.
$\overline{\text{BHE}}$ , $\overline{\text{BLE}}$	40, 39	Input/Control	<b>Byte Write Select Inputs, active LOW.</b> $\overline{\text{BHE}}$ controls I/O <sub>16</sub> –I/O <sub>9</sub> , $\overline{\text{BLE}}$ controls I/O <sub>8</sub> –I/O <sub>1</sub> .
$\overline{\text{OE}}$	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	5V ± 10%
Automotive	-40°C to +125°C	5V ± 10%

**Electrical Characteristics Over the Operating Range**

Parameter	Description	Test Conditions	-12		-15		Unit	
			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		V	
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = Min., I <sub>OL</sub> = 8.0 mA		0.4		0.4	V	
V <sub>IH</sub>	Input HIGH Voltage		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	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	μA
			Auto			-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	μA
			Auto			-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		140		130	mA
			Auto				130	mA
I <sub>SB1</sub>	Automatic CE Power Down Current —TTL Inputs	Max. V <sub>CC</sub> , $\overline{CE} \geq V_{IH}$ 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	mA
			Auto				50	mA
I <sub>SB2</sub>	Automatic CE Power Down Current —CMOS Inputs	Max. V <sub>CC</sub> , $\overline{CE} \geq V_{CC} - 0.3V$ , 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	mA
			Auto				15	mA
			L Version		0.5		0.5	mA

**Capacitance<sup>[4]</sup>**

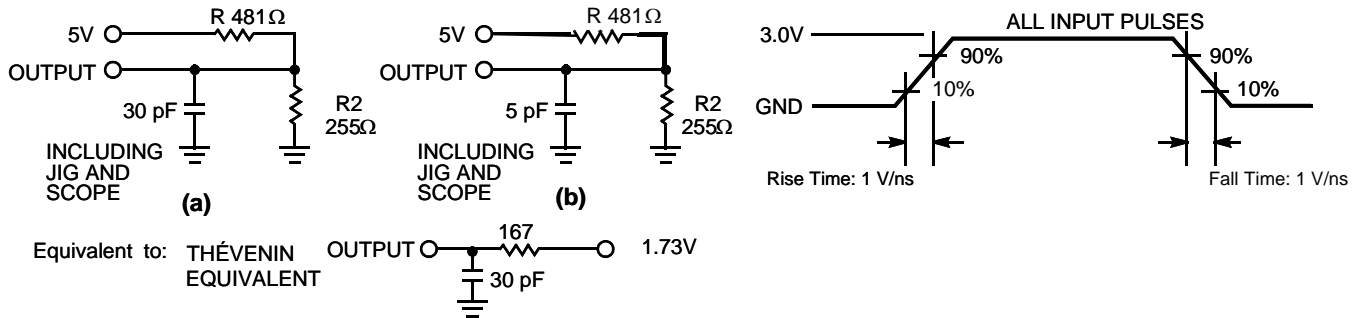
Parameter	Description	Test Conditions	Max.	Unit
C <sub>IN</sub>	Input Capacitance	T <sub>A</sub> = 25°C, f = 1 MHz, V <sub>CC</sub> = 5.0V	8	pF
C <sub>OUT</sub>	Output Capacitance		8	pF

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

Parameter	Description	Test Conditions	44-pin SOJ	44-pin TSOP-II	Unit
Θ <sub>JA</sub>	Thermal Resistance (Junction to Ambient)	Test conditions follow standard test methods and procedures for measuring thermal impedance, per EIA/JESD51.	64.32	76.89	°C/W
Θ <sub>JC</sub>	Thermal Resistance (Junction to Case)		31.03	14.28	°C/W

**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.

**AC Test Loads and Waveforms**

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

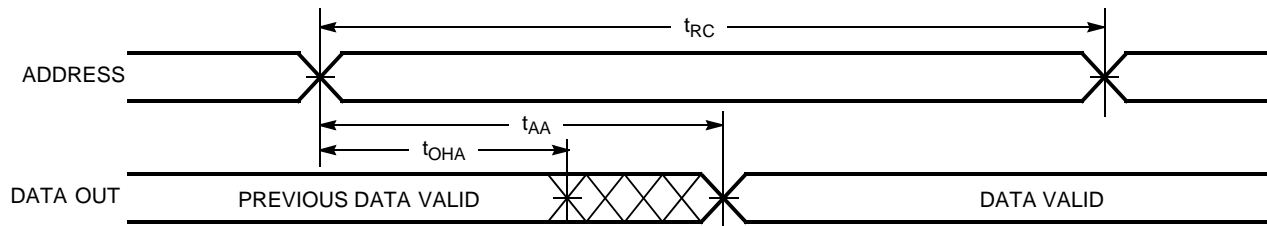
Parameter	Description	7C1021B-12		7C1021B-15		Unit
		Min.	Max.	Min.	Max.	
<b>Read Cycle</b>						
$t_{RC}$	Read Cycle Time	12		15		ns
$t_{AA}$	Address to Data Valid		12		15	ns
$t_{OHA}$	Data Hold from Address Change	3		3		ns
$t_{ACE}$	$\overline{CE}$ LOW to Data Valid		12		15	ns
$t_{DOE}$	$\overline{OE}$ LOW to Data Valid		6		7	ns
$t_{LZOE}$	$\overline{OE}$ LOW to Low Z <sup>[6]</sup>	0		0		ns
$t_{HZOE}$	$\overline{OE}$ HIGH to High Z <sup>[6, 7]</sup>		6		7	ns
$t_{LZCE}$	$\overline{CE}$ LOW to Low Z <sup>[6]</sup>	3		3		ns
$t_{HZCE}$	$\overline{CE}$ HIGH to High Z <sup>[6, 7]</sup>		6		7	ns
$t_{PU}$	$\overline{CE}$ LOW to Power-Up	0		0		ns
$t_{PD}$	$\overline{CE}$ HIGH to Power-Down		12		15	ns
$t_{DBE}$	Byte Enable to Data Valid		6		7	ns
$t_{LZBE}$	Byte Enable to Low Z	0		0		ns
$t_{HZBE}$	Byte Disable to High Z		6		7	ns
<b>Write Cycle<sup>[8]</sup></b>						
$t_{WC}$	Write Cycle Time	12		15		ns
$t_{SCE}$	$\overline{CE}$ LOW to Write End	9		10		ns
$t_{AW}$	Address Set-Up to Write End	8		10		ns
$t_{HA}$	Address Hold from Write End	0		0		ns
$t_{SA}$	Address Set-Up to Write Start	0		0		ns
$t_{SD}$	Data Set-Up to Write End	6		8		ns
$t_{HD}$	Data Hold from Write End	0		0		ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low Z <sup>[6]</sup>	3		3		ns
$t_{HZWE}$	$\overline{WE}$ LOW to High Z <sup>[6, 7]</sup>		6		7	ns
$t_{BW}$	Byte Enable to End of Write	8		9		ns

**Notes:**

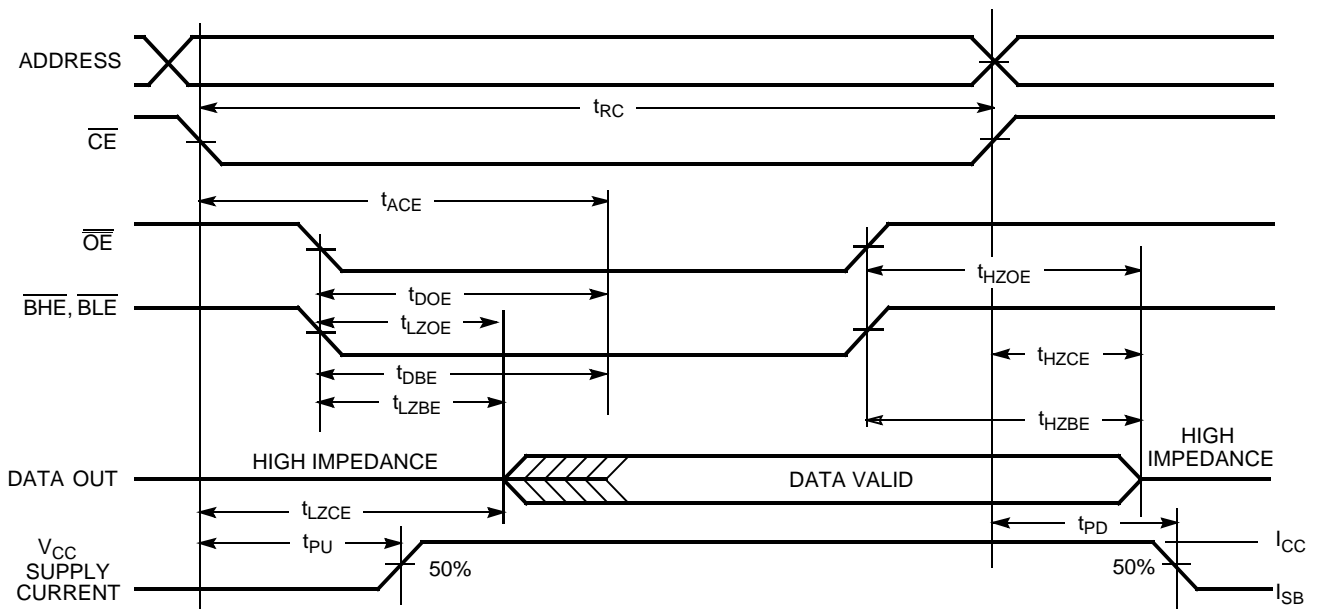
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified  $I_{OL}/I_{OH}$  and 30-pF load capacitance.
- At any given temperature and voltage condition,  $t_{HZCE}$  is less than  $t_{LZCE}$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

### Switching Waveforms

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



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

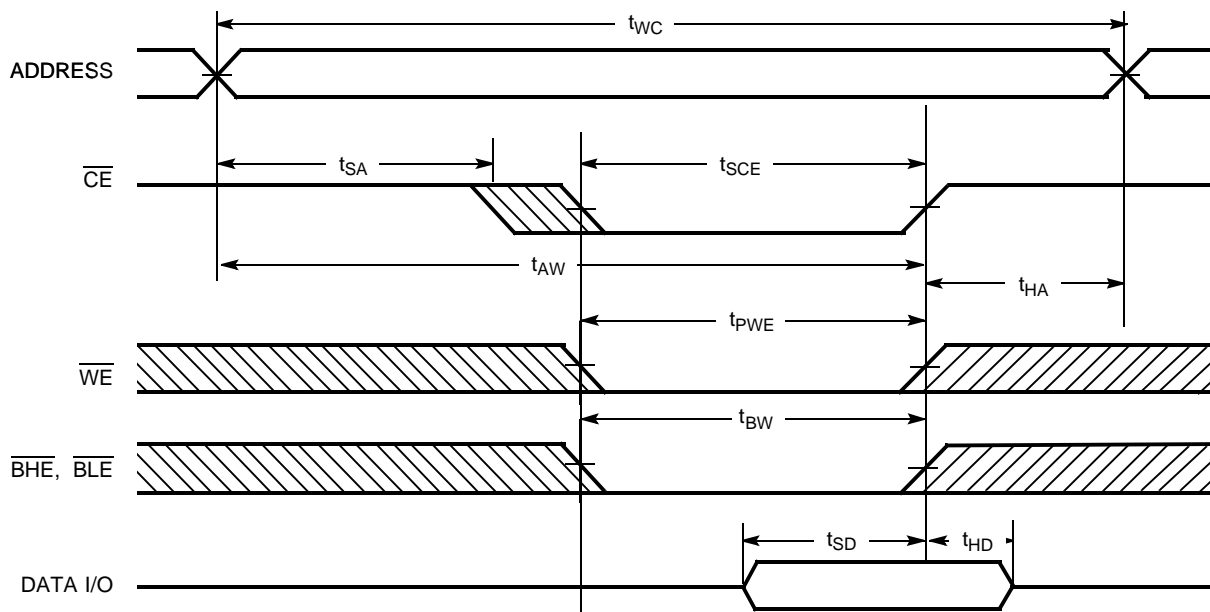


**Notes:**

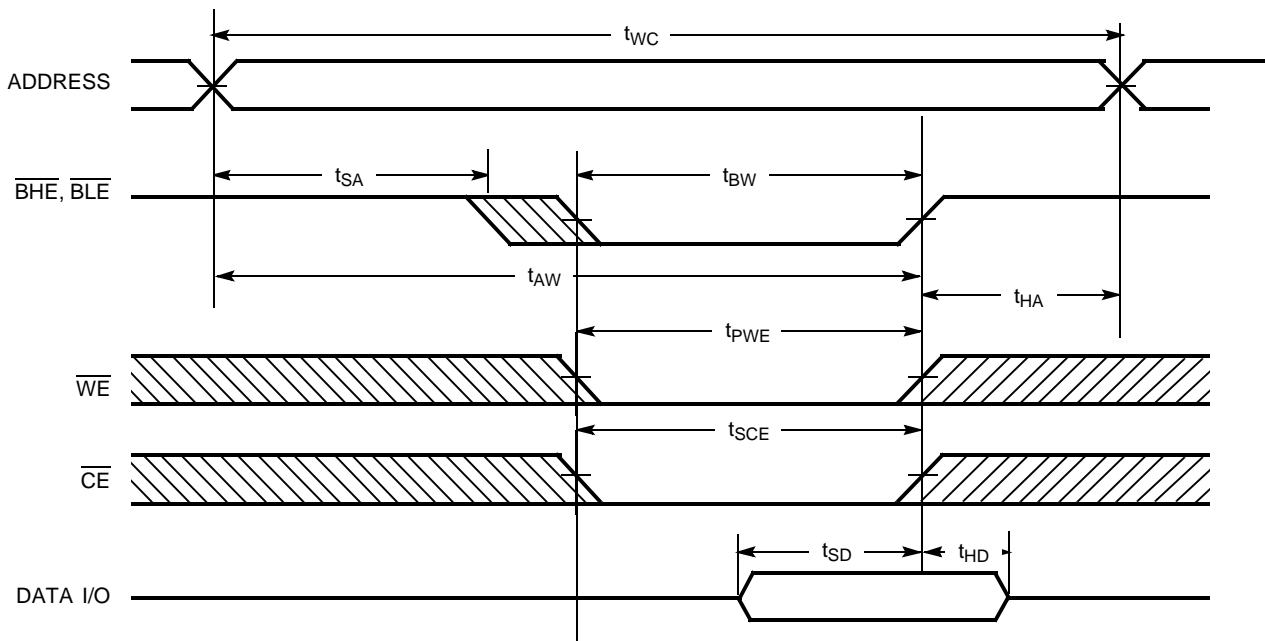
- 9. Device is continuously selected.  $\overline{OE}$ ,  $\overline{CE}$ ,  $\overline{BHE}$  and/or  $\overline{BLA}$  =  $V_{IL}$ .
- 10.  $\overline{WE}$  is HIGH for read cycle.
- 11. Address valid prior to or coincident with  $\overline{CE}$  transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 (CE Controlled)<sup>[12, 13]</sup>



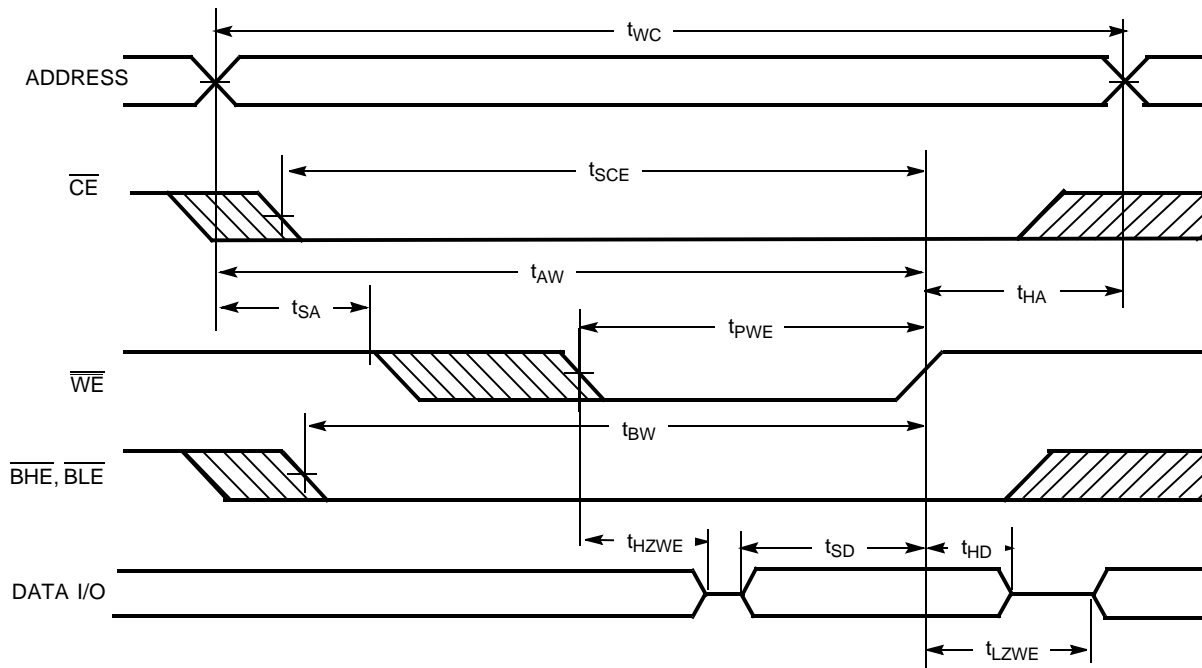
Write Cycle No. 2 ( $\overline{BLE}$  or  $\overline{BHE}$  Controlled)



Notes:

- 12. Data I/O is high impedance if  $\overline{OE}$  or  $\overline{BHE}$  and/or  $\overline{BLE} = V_{IH}$ .
- 13. If 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**

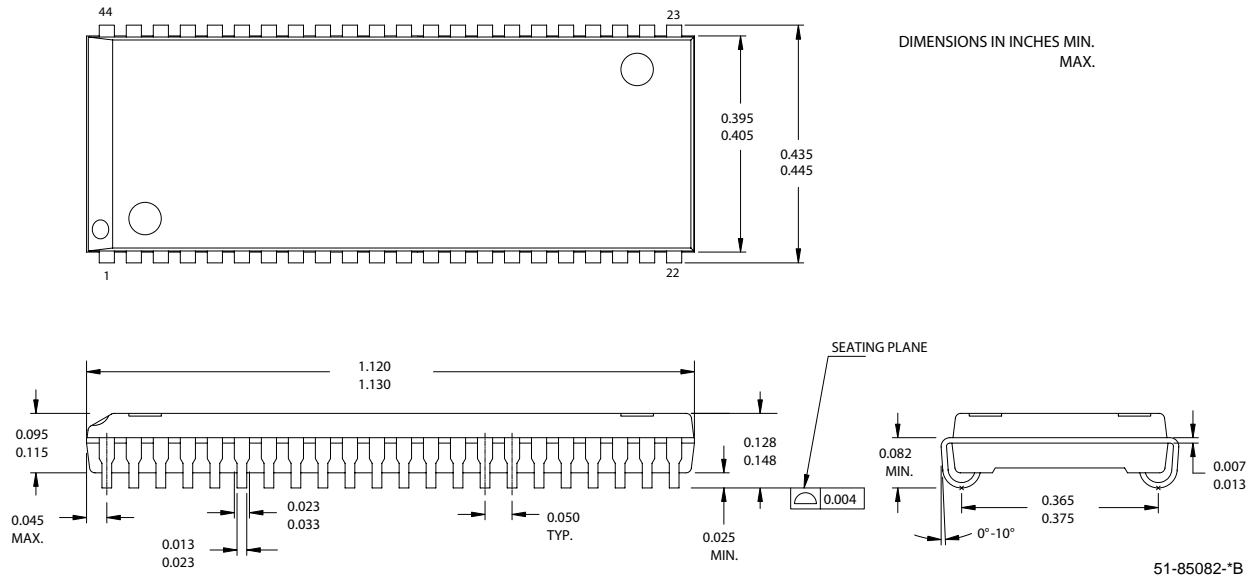
Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
12	CY7C1021B-12VC	51-85082	44-pin (400-Mil) Molded SOJ	Commercial
	CY7C1021B-12VXC		44-pin (400-Mil) Molded SOJ (Pb-Free)	
	CY7C1021B-12ZC	51-85087	44-pin TSOP Type II	
	CY7C1021B-12ZXC		44-pin TSOP Type II (Pb-Free)	
	CY7C1021B-12VI	51-85082	44-pin (400-Mil) Molded SOJ	Industrial
	CY7C1021B-12VXI		44-pin (400-Mil) Molded SOJ (Pb-Free)	

**Ordering Information** (continued)

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
15	CY7C1021B-15VC	51-85082	44-pin (400-Mil) Molded SOJ	Commercial
	CY7C1021B-15VXC		44-pin (400-Mil) Molded SOJ (Pb-Free)	
	CY7C1021B-15ZC	51-85087	44-pin TSOP Type II	
	CY7C1021B-15ZXC		44-pin TSOP Type II (Pb-Free)	
	CY7C1021B-15VI	51-85082	44-pin (400-Mil) Molded SOJ	Industrial
	CY7C1021B-15VXI		44-pin (400-Mil) Molded SOJ (Pb-Free)	
	CY7C1021B-15ZI	51-85087	44-pin TSOP Type II	
	CY7C1021BL-15ZI		44-pin TSOP Type II	
	CY7C1021B-15ZXI		44-pin TSOP Type II (Pb-Free)	
	CY7C1021BL-15ZXI		44-pin TSOP Type II (Pb-Free)	
	CY7C1021B-15VE	51-85082	44-pin (400-Mil) Molded SOJ	Automotive
	CY7C1021B-15VXE		44-pin (400-Mil) Molded SOJ (Pb-Free)	
CY7C1021B-15ZE	51-85087	44-pin TSOP Type II		
CY7C1021B-15ZSXE		44-pin TSOP Type II (Pb-Free)		

**Package Diagrams**

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

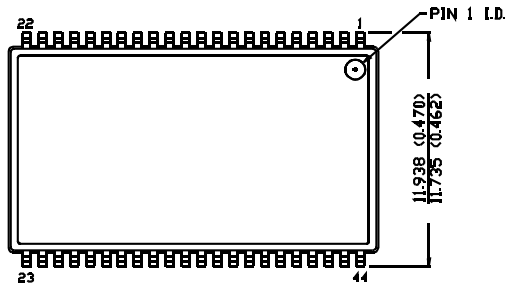




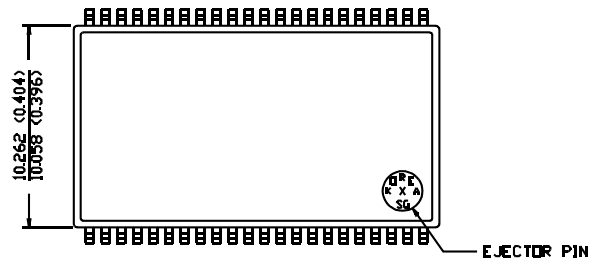
Package Diagrams (continued)

44-Pin TSOP II (51-85087)

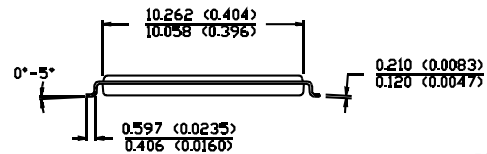
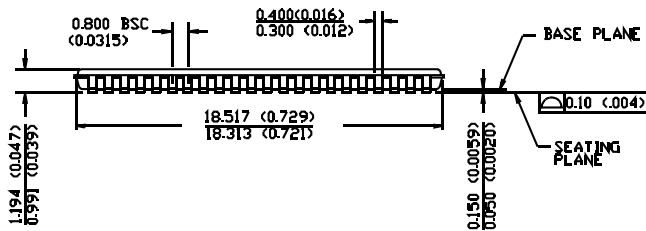
DIMENSION IN MM (INCH)  
MAX  
MIN



TOP VIEW



BOTTOM VIEW



51-85087-\*A

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**Document History Page**

Document Title: CY7C1021B 1-Mbit (64K x 16) Static RAM				
Document Number: 38-05145				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	109889	09/22/01	SZV	Change from Spec number: 38-00951 to 38-05145
*A	238454	See ECN	RKF	1) Added Automotive Specs to Data Sheet 2) Added Pb-Free device offering in the Ordering Information
*B	361795	See ECN	SYT	Added Pb-Free offerings in the Ordering Information
*C	505726	See ECN	NXR	Removed CY7C10211B from Product offering Changed the description of $I_{IX}$ from Input Load Current to Input Leakage Current in DC Electrical Characteristics table Changed teh $I_{CC}$ Max value from 150 mA to 130 mA Removed $I_{OS}$ parameter from DC Electrical Characteristics table Updated Ordering Information Table