CY7C1021BN

1-Mbit (64 K × 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} = 15 ns (Automotive)
- Complementary metal oxide semiconductor (CMOS) for optimum speed/power
- Low active power
  - 825 mW (maximum)
- 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

The CY7C1021BN 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 the input/output (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}).

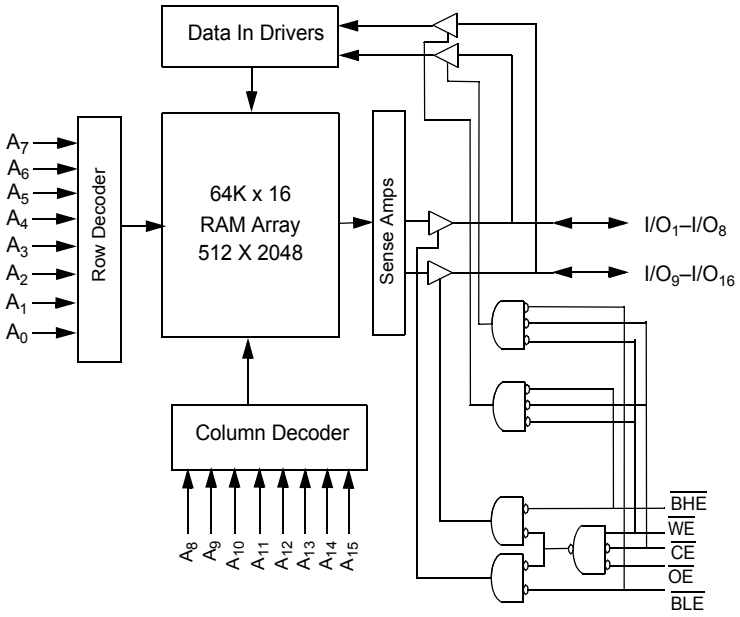
Reading from the device is accomplished by taking $\overline{CE}$ and Output Enable ($\overline{OE}$) LOW while forcing $\overline{WE}$ HIGH. If $\overline{BLE}$ is LOW, then data from the memory location specified by the address pins appears on I/O_1 to I/O_8. If $\overline{BHE}$ is LOW, then data from memory appears on I/O_9 to I/O_{16}. See the Truth Table on page 11 for a complete description of read and write modes.

The I/O 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, $\overline{WE}$ LOW).

The CY7C1021BN is available in standard 44-pin TSOP type II and 44-pin 400-mil-wide SOJ packages. Use part number CY7C1021BN when ordering 15 ns t_{AA}.

For a complete list of related resources, click here.

Logic Block Diagram



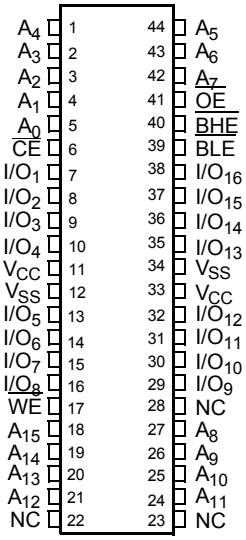
Contents

Selection Guide

Description		CY7C1021B-15
Maximum access time (ns)		15
Maximum operating current (mA)	Commercial/Industrial	130
	Automotive-A	130
	Automotive-E	130
Maximum CMOS standby current (mA)	Commercial/Industrial	10
	Commercial/Industrial (L version)	0.5
	Automotive-A (L version)	0.5
	Automotive-E	15

Pin Configuration

Figure 1. 44-pin SOJ/TSOP II pinout (Top View)



Pin Definitions

Pin Name	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	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 enable 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 tristated, 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

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} relative to GND [1] .....–0.5 V to +7.0 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

Static discharge voltage (per MIL-STD-883, Method 3015) ..... > 2001 V

Latch-up current ..... > 200 mA

Operating Range

Range	Ambient Temperature (T_A)[2]	V_{CC}
Commercial	0 °C to +70 °C	5 V ± 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		-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	6.0	V
V_{IL}	Input LOW voltage[1]			–0.5	0.8	V
I_{IX}	Input leakage current	GND ≤ V_I ≤ V_{CC}	Commercial / Industrial	–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	Commercial / Industrial	–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} = $1/t_{RC}$	Commercial / Industrial	–	130	mA
			Automotive-A	–	130	
			Automotive-E	–	130	
I_{SB1}	Automatic CE power down current – TTL inputs	Max V_{CC}, $\overline{CE}$ ≥ V_{IH}, V_{IN} ≥ V_{IH} or V_{IN} ≤ V_{IL}, f = f_{MAX}	Commercial / Industrial	–	40	mA
			Automotive-A	–	40	
			Automotive-E	–	50	
I_{SB2}	Automatic CE power down current – CMOS inputs	Max V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3 V, V_{IN} ≥ V_{CC} – 0.3 V, or V_{IN} ≤ 0.3 V, f = 0	Commercial / Industrial	–	10	mA
			Commercial / Industrial (L)	–	0.5	
			Automotive-A (L)	–	0.5	
			Automotive-E	–	15	

Notes
1. V_{IL} (min.) = –2.0 V and V_{IH}(max) = V_{CC} + 0.5 V for pulse durations of less than 20 ns.
2. T_A is the “Instant On” case temperature.

Capacitance

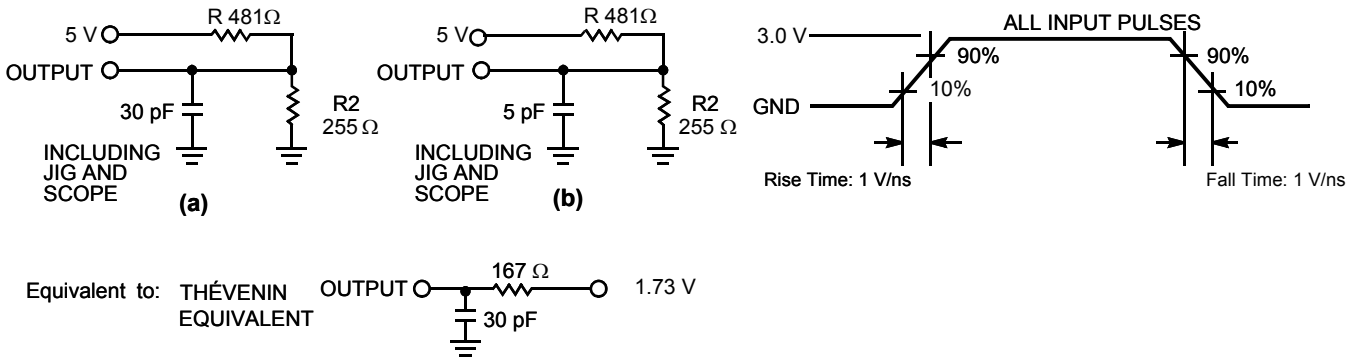
Parameter [3]	Description	Test Conditions	Max	Unit
C_{IN}	Input capacitance	T_A = 25 °C, f = 1 MHz, V_{CC} = 5.0 V	8	pF
C_{OUT}	Output capacitance		8	pF

Thermal Resistance

Parameter [3]	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	°C/W
Θ_{JC}	Thermal resistance (junction to case)		31.03	14.28	°C/W

AC Test Loads and Waveforms

Figure 2. AC Test Loads and Waveforms



Note
3. Tested initially and after any design or process changes that may affect these parameters.

Switching Characteristics

Over the operating range

Parameter [4]	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[4]	0	–	ns
t_{HZOE}	$\overline{OE}$ HIGH to high Z[5, 6]	–	7	ns
t_{LZCE}	$\overline{CE}$ LOW to low Z[5]	3	–	ns
t_{HZCE}	$\overline{CE}$ HIGH to high Z[5, 6]	–	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[5]	0	–	ns
t_{HZBE}	Byte disable to high Z[5, 6]	–	7	ns
Write Cycle [7, 8]				
t_{WC}	Write cycle time	15	–	ns
t_{SCE}	$\overline{CE}$ LOW to write end	10	–	ns
t_{AW}	Address setup to write end	10	–	ns
t_{HA}	Address hold from write end	0	–	ns
t_{SA}	Address setup to write start	0	–	ns
t_{PWE}	$\overline{WE}$ pulse width	12	–	ns
t_{SD}	Data setup to write end	8	–	ns
t_{HD}	Data hold from write end	0	–	ns
t_{LZWE}	$\overline{WE}$ HIGH to low Z[5]	3	–	ns
t_{HZWE}	$\overline{WE}$ LOW to high Z[5, 6]	–	7	ns
t_{BW}	Byte enable to write end	9	–	ns

Notes

4. 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.
5. At any temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZOE} is less than t_{LZOE}, t_{HZBE} is less than t_{LZBE}, and t_{HZWE} is less than t_{LZWE} for any device.
6. t_{HZOE}, t_{HZBE}, t_{HZCE}, and t_{HZWE} are specified with a load capacitance of 5 pF as in part (b) of Figure 2 on page 6. Transition is measured ±500 mV from steady-state voltage.
7. 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 setup and hold timing should be referenced to the leading edge of the signal that terminates the write.
8. The minimum write cycle pulse width for the Write Cycle No. 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW) should be equal to sum of t_{SD} and t_{HZWE}.

Switching Waveforms

Figure 3. Read Cycle No. 1 [9, 10]

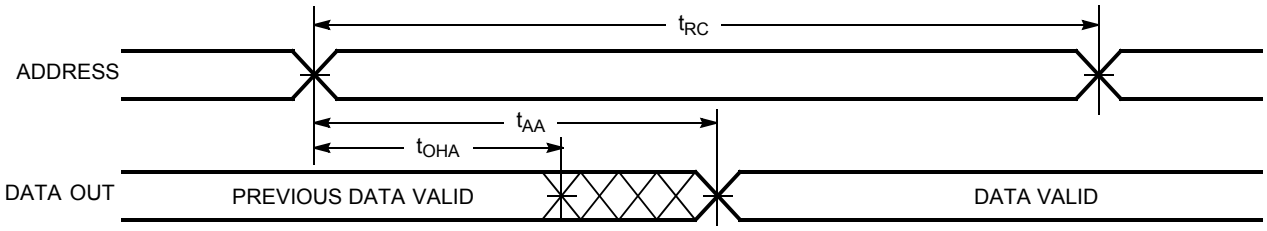
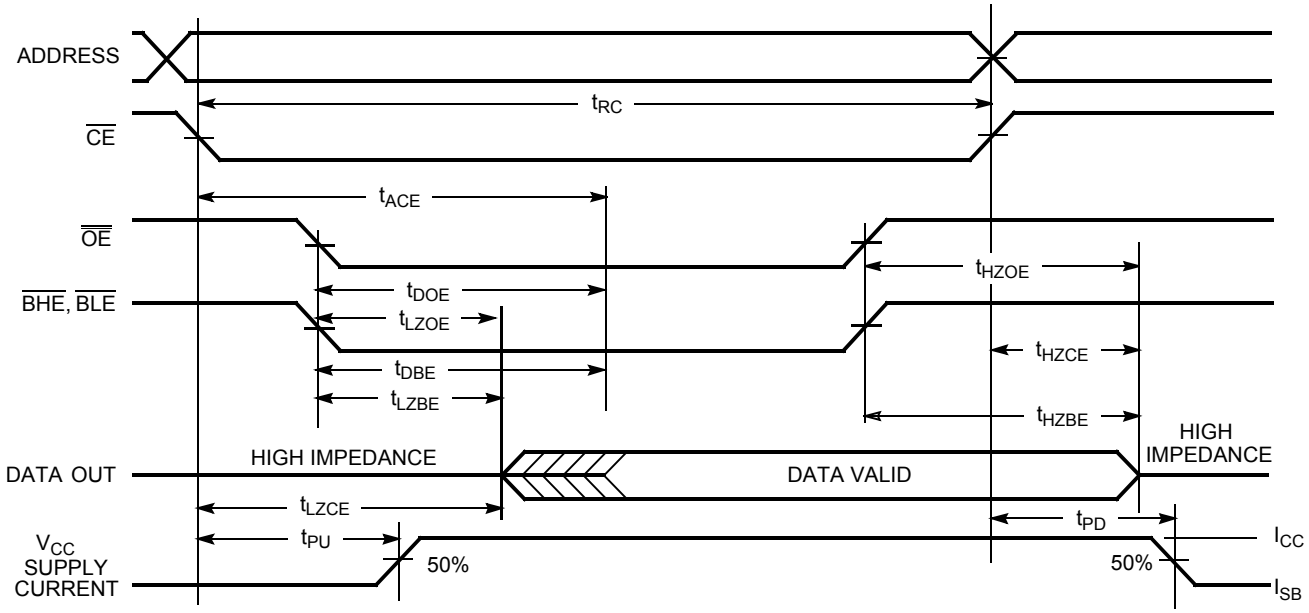


Figure 4. Read Cycle No. 2 ($\overline{OE}$ Controlled) [10, 11]



Notes
9. Device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{BHE}$, and $\overline{BHE}$ = 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)

Figure 5. Write Cycle No. 1 ($\overline{CE}$ Controlled) [12, 13]

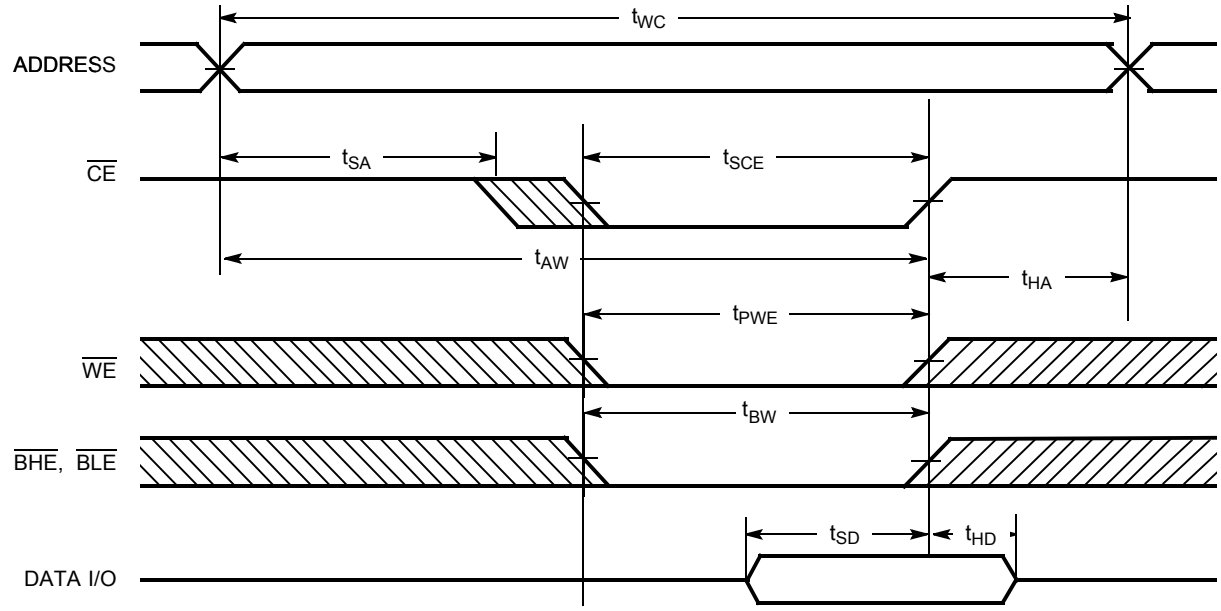
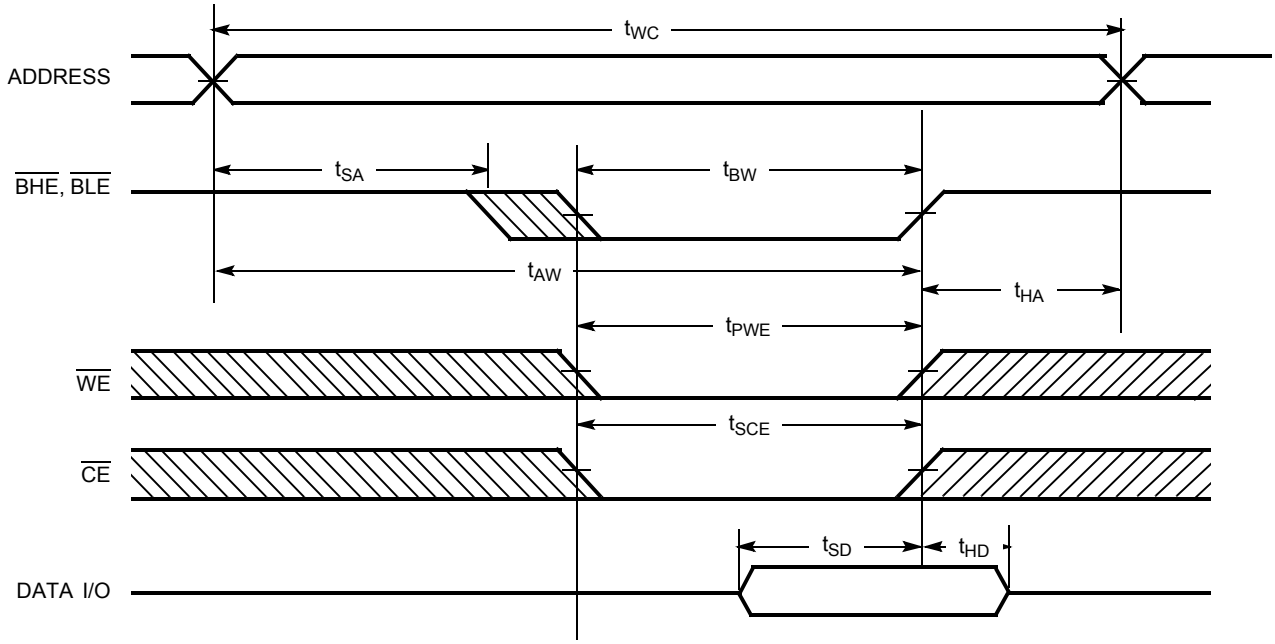


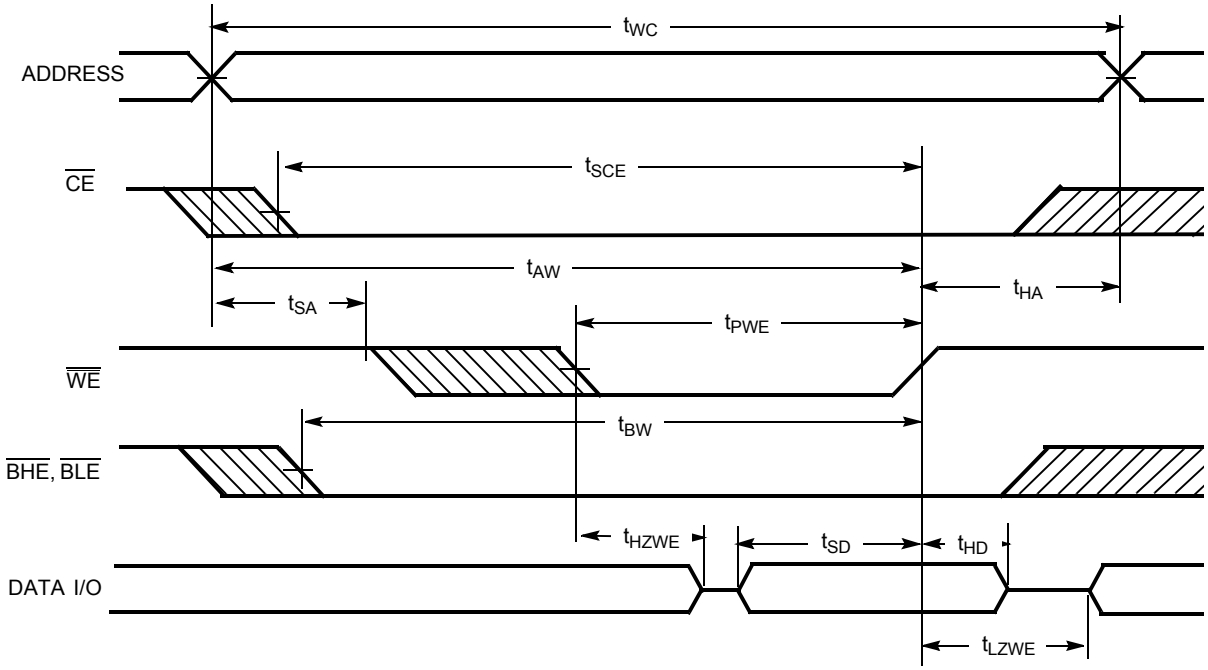
Figure 6. Write Cycle No. 2 ($\overline{BLE}$ or $\overline{BHE}$ Controlled)



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

Switching Waveforms (continued)

Figure 7. 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

Cypress offers other versions of this product type 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, refer to the product summary page at http://www.cypress.com/products or contact your local sales representative.

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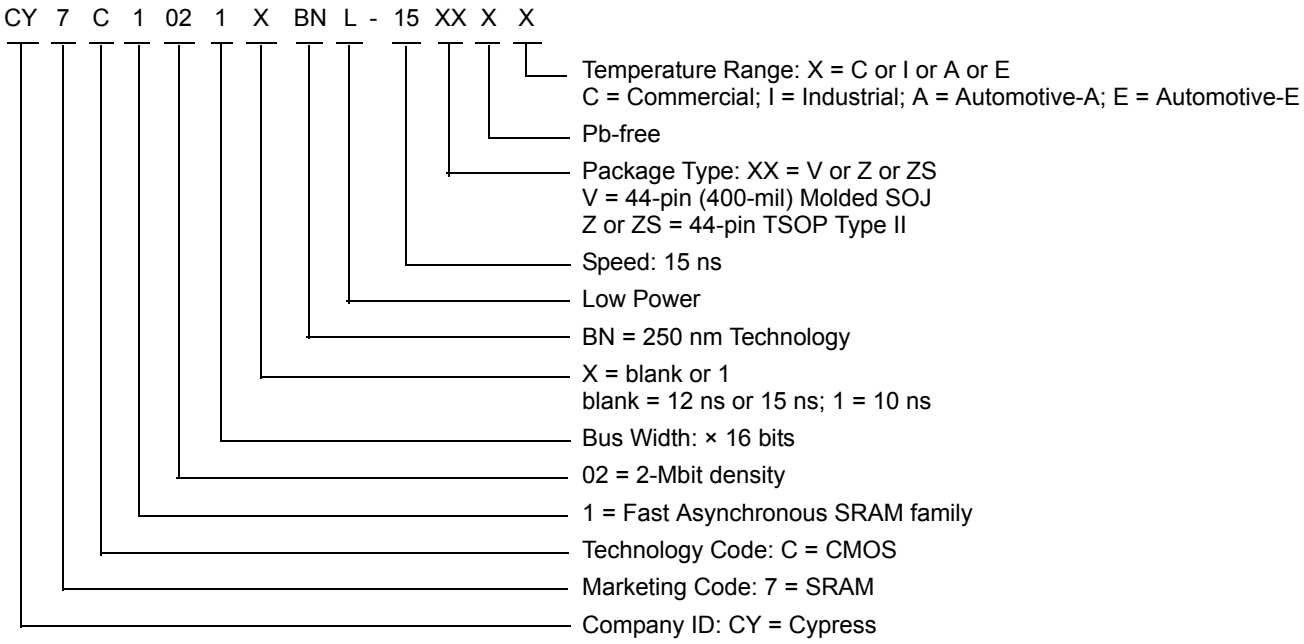
Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
15	CY7C1021BNL-15VXC	51-85082	44-pin (400-mil) Molded SOJ (Pb-free)	Commercial
	CY7C1021BNL-15ZXI	51-85087	44-pin TSOP Type II (Pb-free)	Industrial
	CY7C1021BNL-15ZSXA	51-85087	44-pin TSOP Type II (Pb-free)	Automotive-A
	CY7C1021BN-15ZSXE			Automotive-E

Ordering Code Definitions



Package Diagrams

Figure 8. 44-pin SOJ (400 Mils) V44.4 Package Outline, 51-85082

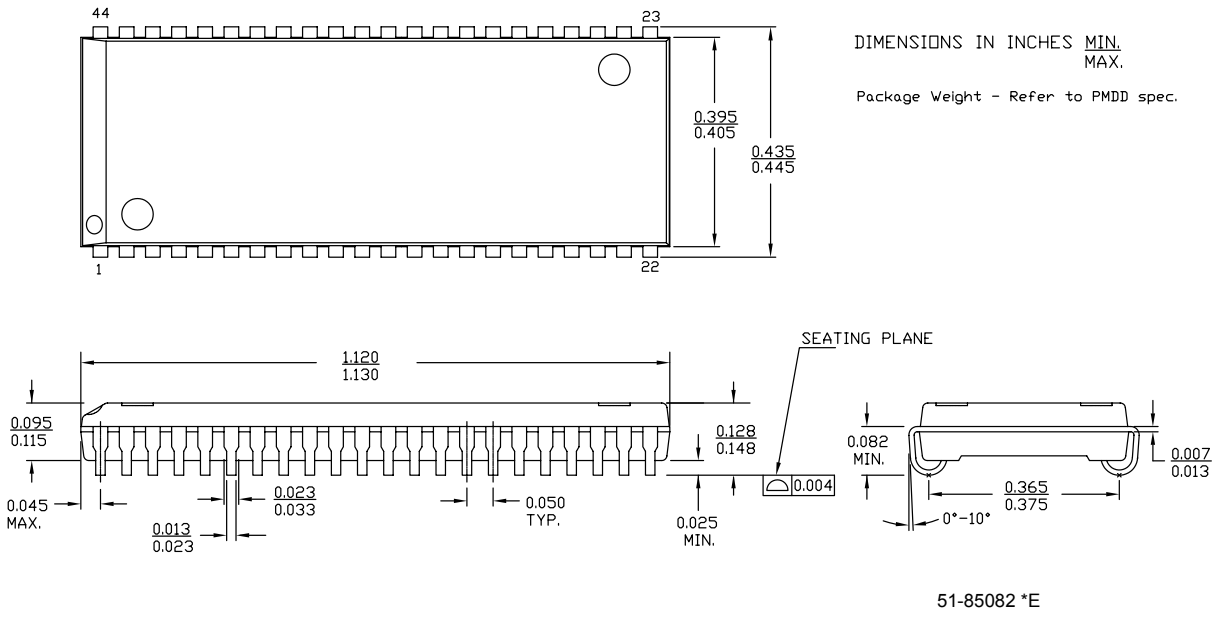
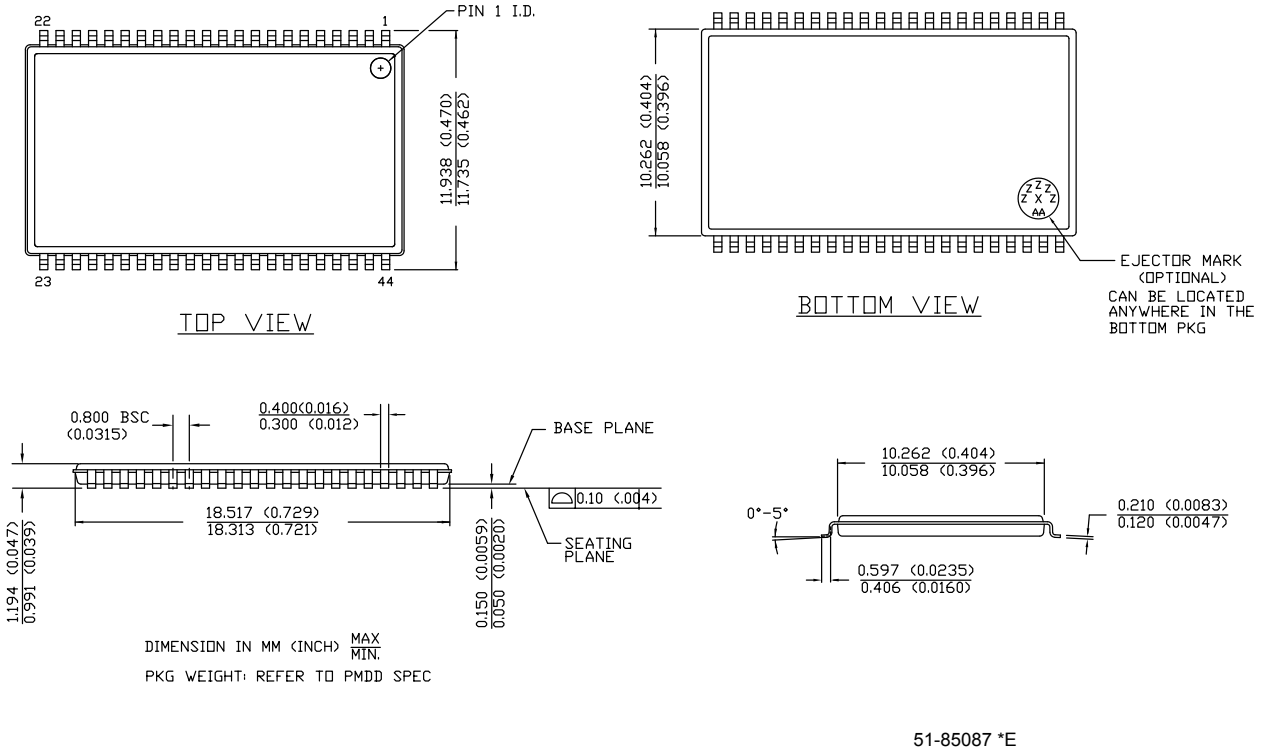


Figure 9. 44-pin TSOP Z44-II Package Outline, 51-85087



Acronyms

Acronym	Description
$\overline{BHE}$	Byte High Enable
$\overline{BLE}$	Byte Low Enable
$\overline{CE}$	Chip Enable
CMOS	Complementary Metal Oxide Semiconductor
I/O	Input/Output
$\overline{OE}$	Output Enable
SOJ	Small Outline J-lead
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
mA	milliampere
mm	millimeter
mW	milliwatt
ns	nanosecond
Ω	ohm
%	percent
pF	picofarad
V	volt
W	watt

Document History Page

Document Title: CY7C1021BN, 1-Mbit (64 K × 16) Static RAM Document Number: 001-06494				
Rev.	**ECN No.**	**Submission 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. Updated Ordering Information (Added Automotive products).
*B	2897061	03/22/10	AJU	Updated Ordering Information (Removed obsolete parts). Updated Package Diagrams.
*C	2947254	06/08/10	RAME	Updated Pin Definitions (Replaced "Byte write select inputs" with "Byte Enable select inputs" in description of pin $\overline{BHE}$, $\overline{BLE}$). Updated AC Test Loads and Waveforms (Updated Figure 2 (Added ohm (Ω) symbol in Thevenin equivalent circuit)). Updated Switching Characteristics (Updated Note 5 (Included t_{HZBE} and t_{LZBE} in the note)). Updated Ordering Information (Included operating range for CY7C1021BNL-15ZXI in ordering information table).
*D	3328634	26/07/2011	AJU	Updated Features (Removed the information associated with speed bins -10 and -12). Removed the note "For best practice recommendations, refer to the Cypress application note, SRAM System Design Guidelines-AN1064." in page 1 and its reference in Functional Description. Updated Functional Description (Removed the information associated with speed bins -10 and -12). Updated Selection Guide (Removed the information associated with speed bins -10 and -12). Updated Electrical Characteristics (Removed the information associated with speed bins -10 and -12). Updated Switching Characteristics (Removed the information associated with speed bins -10 and -12). Updated Ordering Information. Added Acronyms and Units of Measure. Updated to new template.
*E	4125119	09/16/2013	VINI	Updated Package Diagrams: spec 51-85082 – Changed revision from *C to *E. spec 51-85087 – Changed revision from *C to *E. Updated to new template. Completing Sunset Review.
*F	4545523	10/20/2014	VINI	Updated Document Title to read as "CY7C1021BN, 1-Mbit (64 K × 16) Static RAM". Removed CY7C10211BN related information in all instances across the document. Updated Switching Characteristics: Removed "CY7C1021B" and retained "-15" in column heading "CY7C1021B-15". Added Note 8 and referred the same note in "Write Cycle". Added t_{PWE} parameter and its details. Completing Sunset Review.
*G	4557296	10/31/2014	VINI	Updated Switching Characteristics: Updated minimum and maximum values of t_{PWE} parameter.
*H	4578500	12/16/2014	VINI	Updated Ordering Information: Removed the prune part number CY7C1021BN-15VXE.
*I	4984333	10/23/2015	NILE	Updated to new template. Completing Sunset Review.
*J	5979549	11/29/2017	AESATMP9	Updated logo and copyright.

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