



512K (32K x 16) Static RAM

Features

- Pin- and function-compatible with CY7C1020V33
- Temperature Ranges
 - Commercial: 0°C to 70°C
 - Industrial: -40°C to 85°C
 - Automotive: -40°C to 125°C
- High speed
 - $t_{AA} = 10, 12, 15$ ns
- CMOS for optimum speed/power
- Low active power
 - 360 mW (max.)
- Automatic power-down when deselected
- Independent control of upper and lower bits
- Available in 44-pin TSOP II

Functional Description

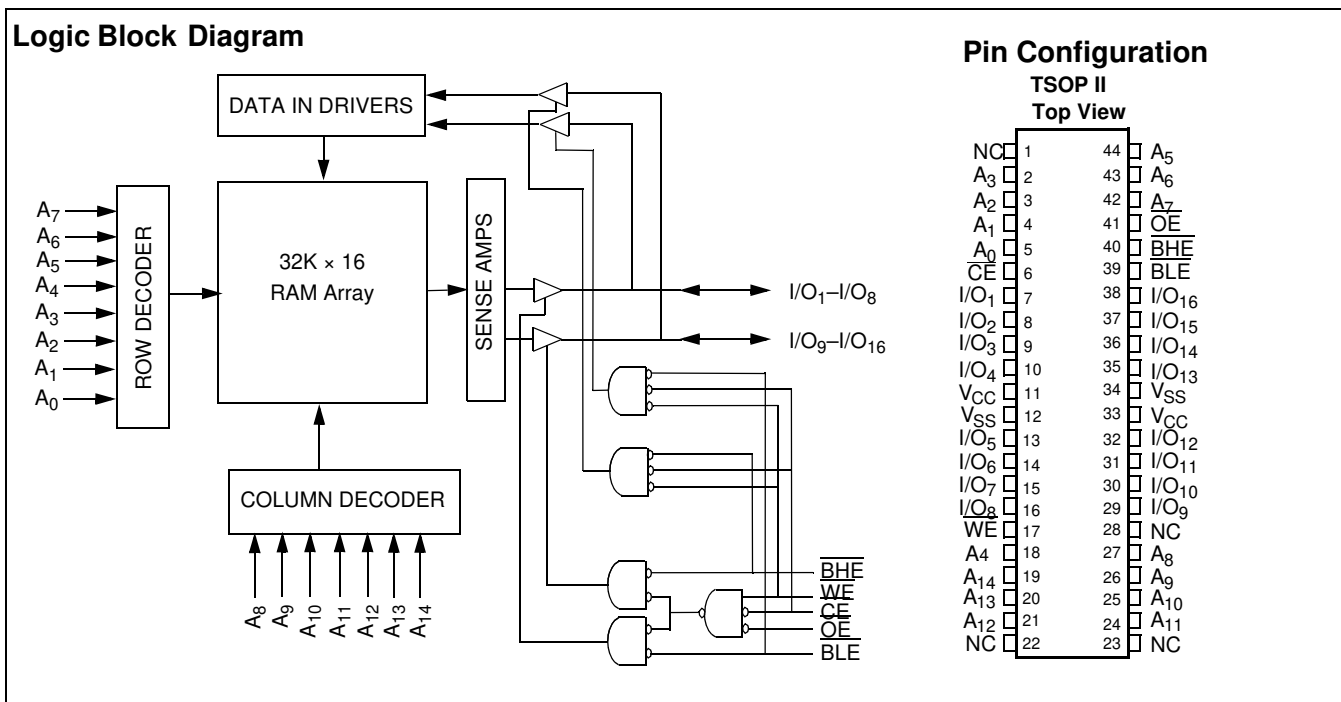
The CY7C1020CV33 is a high-performance CMOS static RAM organized as 32,768 words by 16 bits. This device has an automatic power-down feature that significantly reduces power consumption when deselected.

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/O₁ through I/O₈), is written into the location specified on the address pins (A₀ through A₁₄). 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 A₁₄).

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 CY7C1020CV33 is available in standard 44-pin TSOP Type II package.



Selection Guide

		1020CV33-10	1020CV33-12	1020CV33-15	Unit
Maximum Access Time		10	12	15	ns
Maximum Operating Current	Com'l / Ind'l	90	85	80	mA
	Automotive	-	-	85	mA
Maximum CMOS Standby Current	Com'l / Ind'l	5	5	5	mA
	Automotive	-	-	10	mA

Pin Definitions

Pin Name	TSOP - Pin Number	I/O Type	Description
A ₀ -A ₁₄	5,4,3,2,18,44,43,42,27,26, 25,24,21,20,19	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	1,22,23,28	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, deselected the chip.
\overline{BHE} , \overline{BLE}	40,39	Input/Control	Byte Write Select Inputs, active LOW. \overline{BLE} controls I/O ₈ -I/O ₁ , \overline{BHE} controls I/O ₁₆ -I/O ₉ .
\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 three-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} to Relative GND^[1] -0.5V to +4.6V
 DC Voltage Applied to Outputs in High-Z State^[1] -0.5V to V_{CC} + 0.5V
 DC Input Voltage^[1] -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	V _{CC}
Commercial	0°C to +70°C	3.3V ± 10%
Industrial	-40°C to +85°C	3.3V ± 10%
Automotive	-40°C to +125°C	3.3V ± 10%

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	1020CV33-10		1020CV33-12		1020CV33-15		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		2.0	V _{CC} + 0.3	2.0	V _{CC} + 0.3	2.0	V _{CC} + 0.3	V		
V _{IL}	Input LOW Voltage ^[1]		-0.3	0.8	-0.3	0.8	-0.3	0.8	V		
I _{IX}	Input Load Current	GND ≤ V _I ≤ V _{CC}	Com'l / Ind'l		-1	+1	-1	+1	-1	+1	μA
			Automotive		-	-	-	-	-20	+20	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		-	-	-	-	-20	+20	μA
I _{OS} ^[2]	Output Short Circuit Current	V _{CC} = Max., V _{OUT} = GND		-300		-300		-300		mA	
I _{CC}	V _{CC} Operating Supply Current	V _{CC} = Max., I _{OUT} = 0 mA, f = f _{MAX} = 1/t _{RC}	Com'l / Ind'l			90		85		80	mA
			Automotive			-		-		85	mA
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			15		15		15	mA
			Automotive			-		-		20	mA
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			5		5		5	mA
			Automotive			-		-		10	mA

Capacitance^[3]

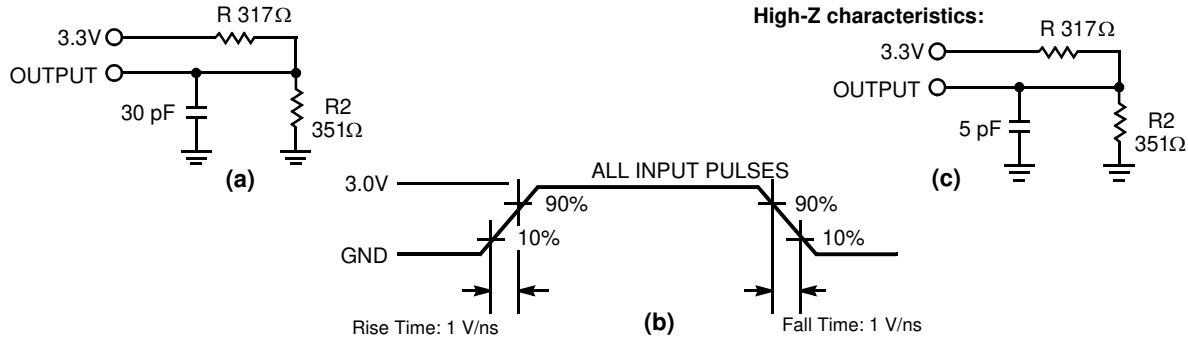
Parameter	Description	Test Conditions	Max.	Unit
C _{IN}	Input Capacitance	T _A = 25°C, f = 1 MHz, V _{CC} = 3.3V	8	pF
C _{OUT}	Output Capacitance		8	pF

Thermal Resistance^[3]

Parameter	Description	Test Conditions	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.	76.92	°C/W
θ _{JC}	Thermal Resistance (Junction to Case)		15.86	°C/W

Notes:

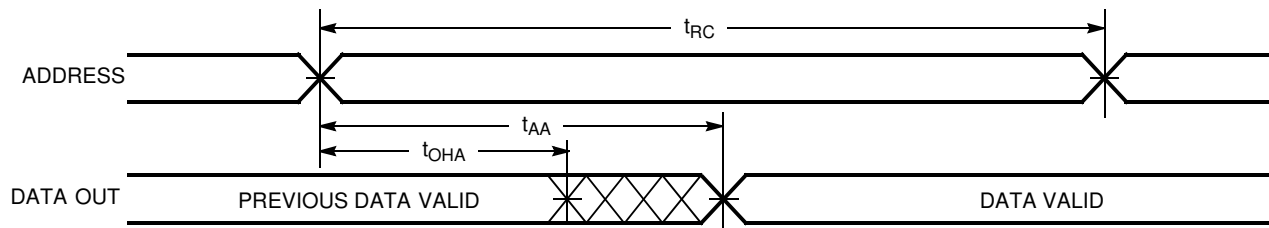
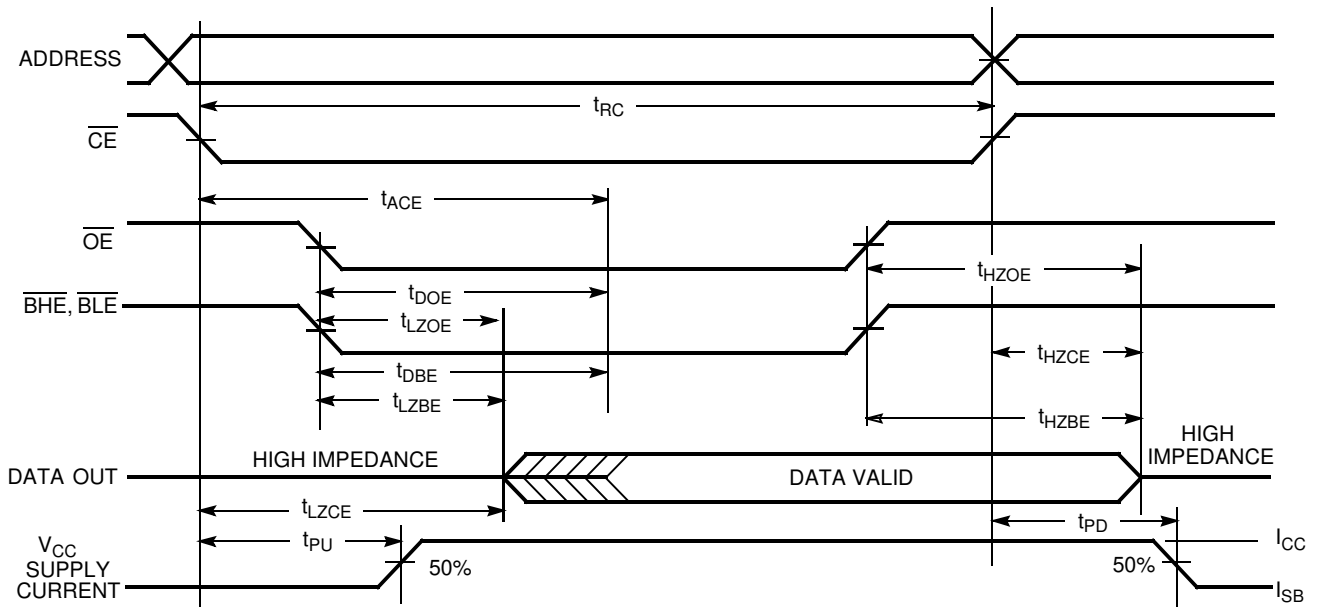
- V_{IL} (min.) = -2.0V and V_{IH} (max) = V_{CC} + 0.5V for pulse durations of less than 20 ns.
- Not more than one output should be shorted at one time. Duration of the short circuit should not exceed 30 seconds.
- Tested initially and after any design or process changes that may affect these parameters.

AC Test Loads and Waveforms^[4]

Switching Characteristics Over the Operating Range^[4]

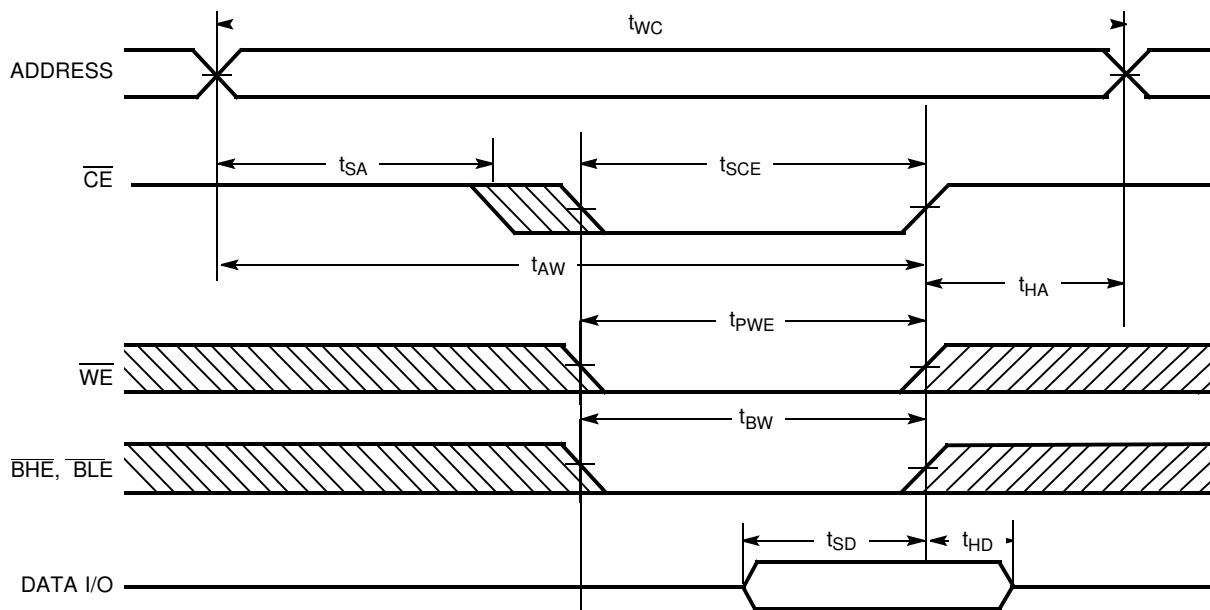
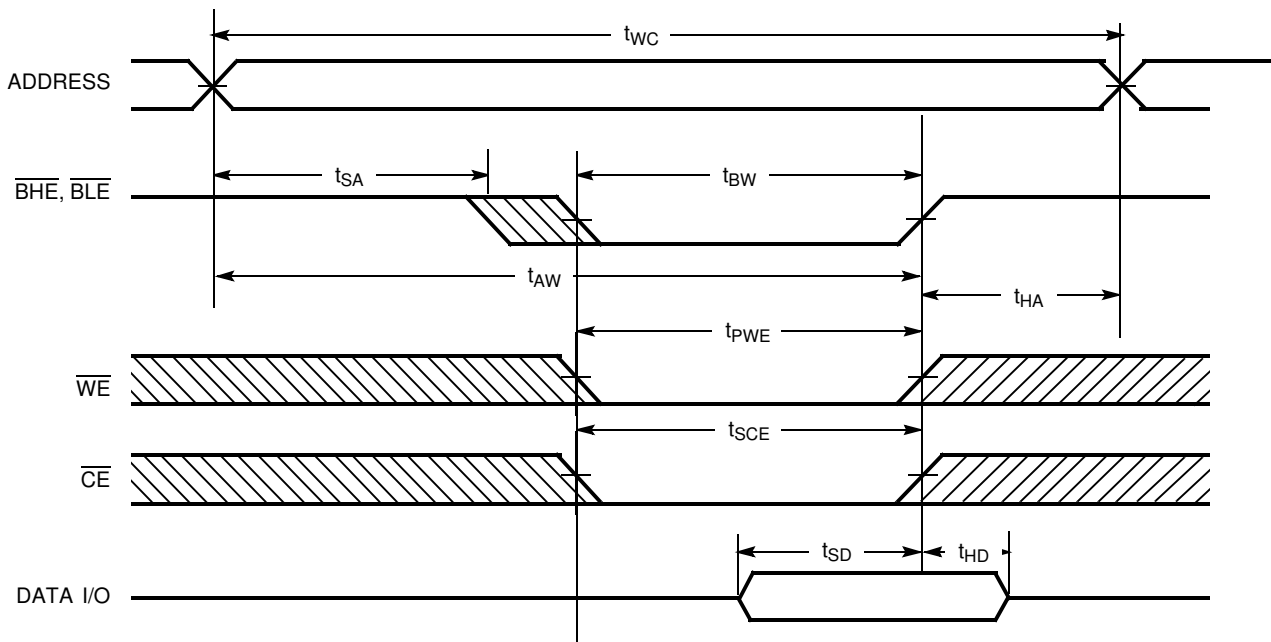
Parameter	Description	1020CV33-10		1020CV33-12		1020CV33-15		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle								
t_{RC}	Read Cycle Time	10		12		15		ns
t_{AA}	Address to Data Valid		10		12		15	ns
t_{OHA}	Data Hold from Address Change	3		3		3		ns
t_{ACE}	\overline{CE} LOW to Data Valid		10		12		15	ns
t_{DOE}	\overline{OE} LOW to Data Valid		5		6		7	ns
t_{LZOE}	\overline{OE} LOW to Low-Z ^[5]	0		0		0		ns
t_{HZOE}	\overline{OE} HIGH to High-Z ^[5, 6]		5		6		7	ns
t_{LZCE}	\overline{CE} LOW to Low-Z ^[5]	3		3		3		ns
t_{HZCE}	\overline{CE} HIGH to High-Z ^[5, 6]		5		6		7	ns
t_{PU} ^[7]	\overline{CE} LOW to Power-up	0		0		0		ns
t_{PD} ^[7]	\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
Write Cycle^[8]								
t_{WC}	Write Cycle Time	10		12		15		ns
t_{SCE}	\overline{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_{PWE}	\overline{WE} Pulse Width	7		8		10		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 ^[5]	3		3		3		ns
t_{HZWE}	\overline{WE} LOW to High-Z ^[5, 6]		5		6		7	ns
t_{BW}	Byte Enable to End of Write	7		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.
- 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 (c) of AC Test Loads. Transition is measured ± 500 mV from steady-state voltage.
- This parameter is guaranteed by design and is not tested.
- 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.

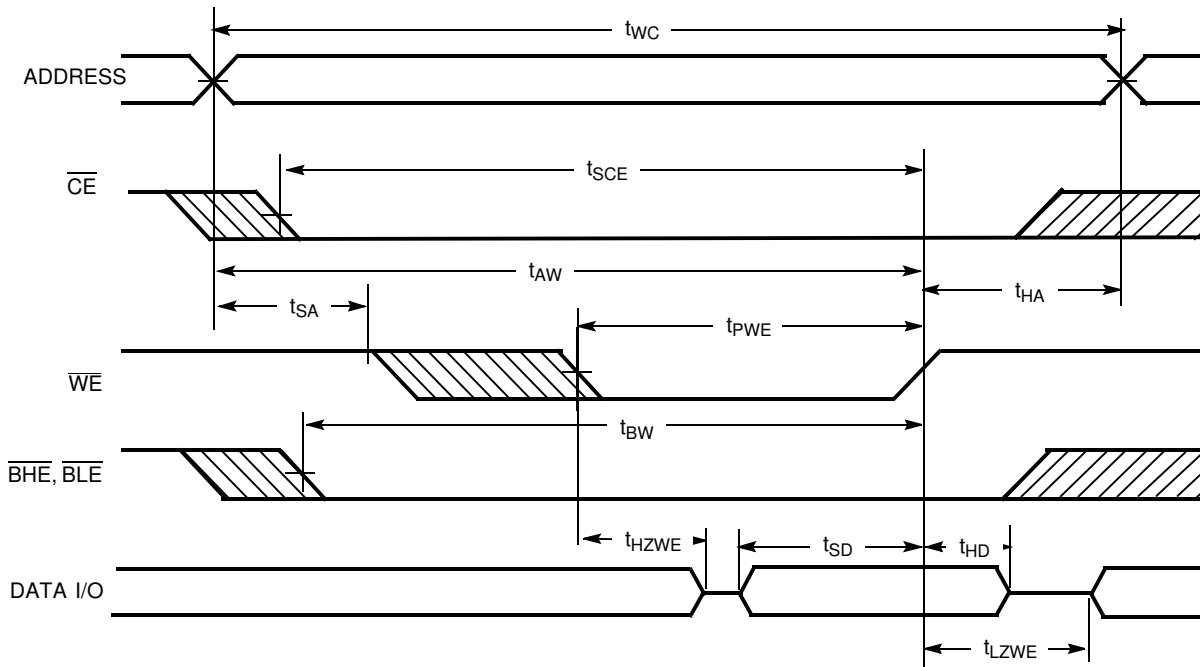
Switching Waveforms
Read Cycle No. 1^[9, 10]

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

Notes:

- 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.
- 11. Address valid prior to or coincident with \overline{CE} transition LOW.

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:

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

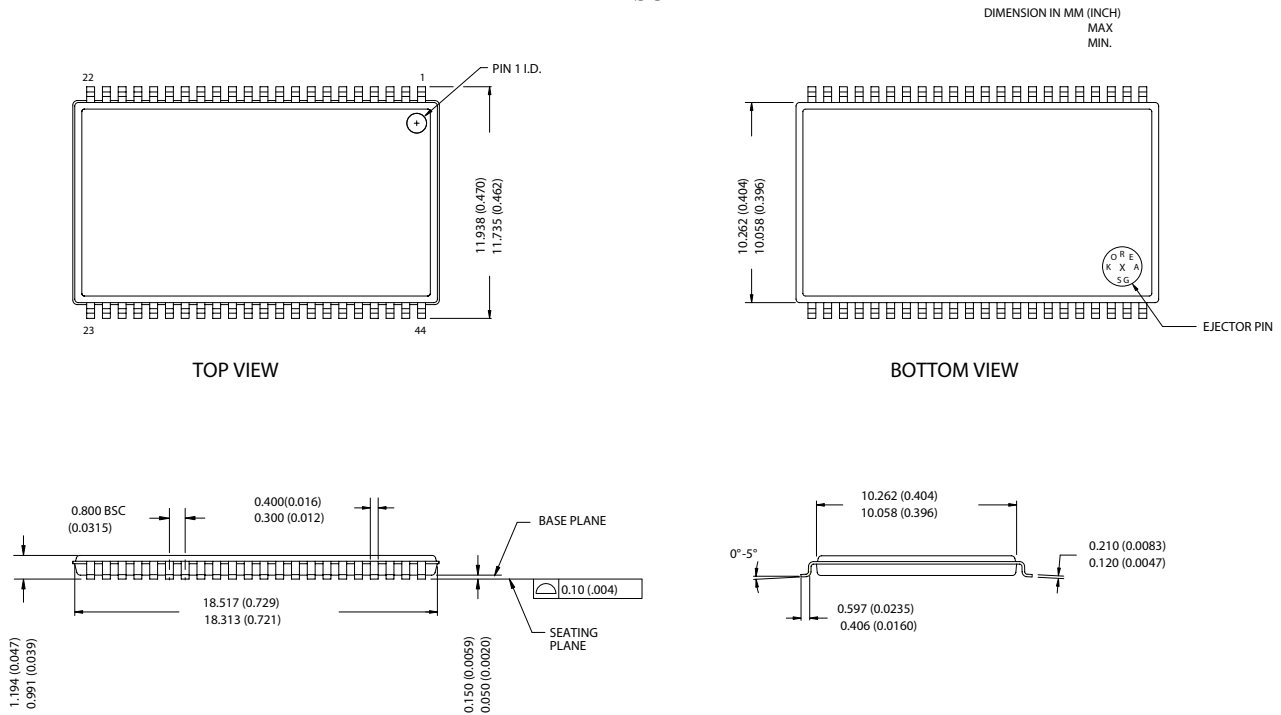
Switching Waveforms (continued)

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

Truth Table

CE	OE	WE	BLE	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 Name	Package Type	Operating Range
10	CY7C1020CV33-10ZC	Z44	44-lead TSOP Type II	Commercial
	CY7C1020CV33-10ZXC	Z44	44-lead TSOP Type II (Pb-Free)	Commercial
	CY7C1020CV33-10ZI	Z44	44-lead TSOP Type II	Industrial
12	CY7C1020CV33-12ZC	Z44	44-lead TSOP Type II	Commercial
	CY7C1020CV33-12ZI	Z44	44-lead TSOP Type II	Industrial
15	CY7C1020CV33-15ZC	Z44	44-lead TSOP Type II	Commercial
	CY7C1020CV33-15ZXC	Z44	44-lead TSOP Type II (Pb-Free)	Commercial
	CY7C1020CV33-15ZI	Z44	44-lead TSOP Type II	Industrial
	CY7C1020CV33-15ZXI	Z44	44-lead TSOP Type II (Pb-Free)	Industrial
	CY7C1020CV33-15ZSE	Z44	44-lead TSOP Type II	Automotive
	CY7C1020CV33-15ZSXE	Z44	44-lead TSOP Type II (Pb-Free)	Automotive

Package Diagrams
44-Pin TSOP II Z44


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Document History Page

Document Title: CY7C1020CV33 512K (32K x 16) Static RAM
Document Number: 38-05133

REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	109428	12/16/01	HGK	New Data Sheet
*A	115045	05/30/02	HGK	I _{CC} and I _{SB1} data modified
*B	117615	08/14/02	DFP	Pin 1= NC Pin 18 = A4; remove SOJ package option; remove 8ns option.
*C	262949	See ECN	RKF	Added Automotive Specs to Datasheet
*D	334398	See ECN	SYT	Added Lead-Free Product Information