CY7C1020

32K x 16 Static RAM

Features

- **5.0V operation (± 10%)**
- **High speed**
  - **— t_{AA} = 10 ns**
- **Low active power**
  - **— 825 mW (max., 10 ns, "L" version)**
- **Very Low standby power**
  - **— 550 μW (max., "L" version)**
- **Automatic power-down when deselected**
- **Independent Control of Upper and Lower bytes**
- **Available in 44-pin TSOP II and 400-mil SOJ**

Functional Description

The CY7C1020 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.

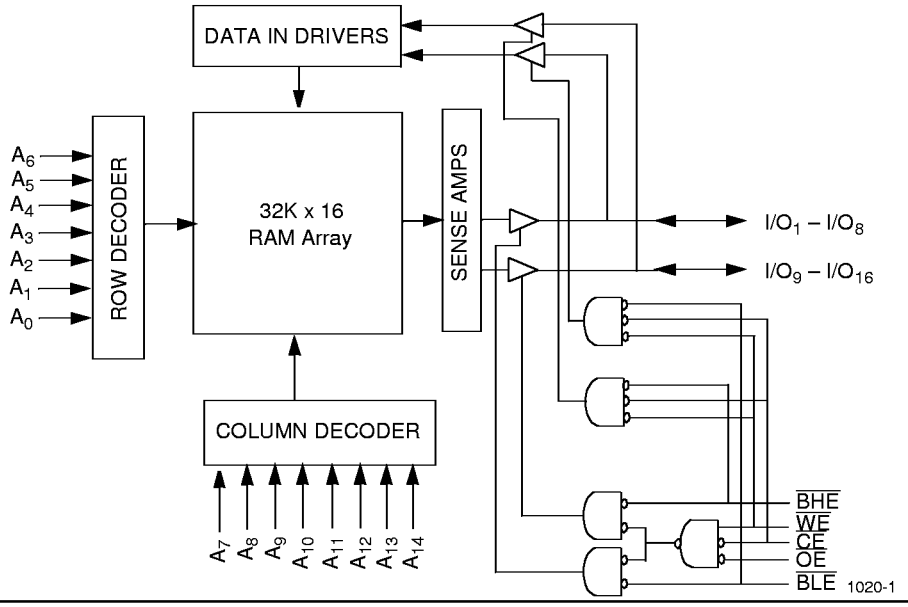
Writing to the device is accomplished by taking Chip Enable ($\overline{CE}$) and Write Enable ($\overline{WE}$) inputs LOW. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from I/O pins (I/O_1 through I/O_8), is written into the location specified on the address pins (A_0 through A_{14}). If 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_{14}).

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).

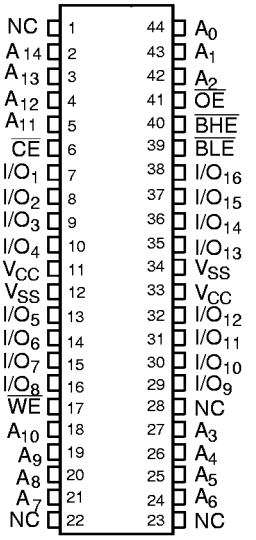
The CY7C1020 is available in standard 44-pin TSOP type II and 400-mil-wide SOJ packages.

Logic Block Diagram



Pin Configuration

SOJ / TSOP II
Top View



Selection Guide

		7C1020-10	7C1020-12	7C1020-15	7C1020-20
Maximum Access Time (ns)		10	12	15	20
Maximum Operating Current (mA)		180	170	160	160
	L	150	140	130	130
Maximum CMOS Standby Current (mA)		3	3	3	3
	L	0.1	0.1	0.1	0.1

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 +7.0V

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[2]	V_{CC}
Commercial	0°C to +70°C	4.5V–5.5V

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions		7C1020-10 Min.	7C1020-10 Max.	7C1020-12 Min.	7C1020-12 Max.	7C1020-15 Min.	7C1020-15 Max.	Unit
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[1]			–0.5	0.8	–0.5	0.8	–0.5	0.8	V
I_{IX}	Input Load Current	GND ≤ V_I ≤ V_{CC}		–1	+1	–1	+1	–1	+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_I ≤ V_{CC}, Output Disabled		–2	+2	–2	+2	–2	+2	µA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., I_{OUT} = 0 mA, f = f_{MAX} = $1/t_{RC}$			180		170		160	mA
			L		150		140		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}			20		20		20	mA
			L		10		10		10	
I_{SB2}	Automatic CE Power-Down Current —CMOS Inputs	Max. V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3V, V_{IN} ≥ V_{CC} – 0.3V, or V_{IN} ≤ 0.3V, f = 0			3		3		3	mA
			L		100		100		100	µA

Notes:

1. V_{IL} (min.) = –2.0V for pulse durations of less than 20 ns.
2. T_A is the case temperature.

Electrical Characteristics Over the Operating Range (continued)

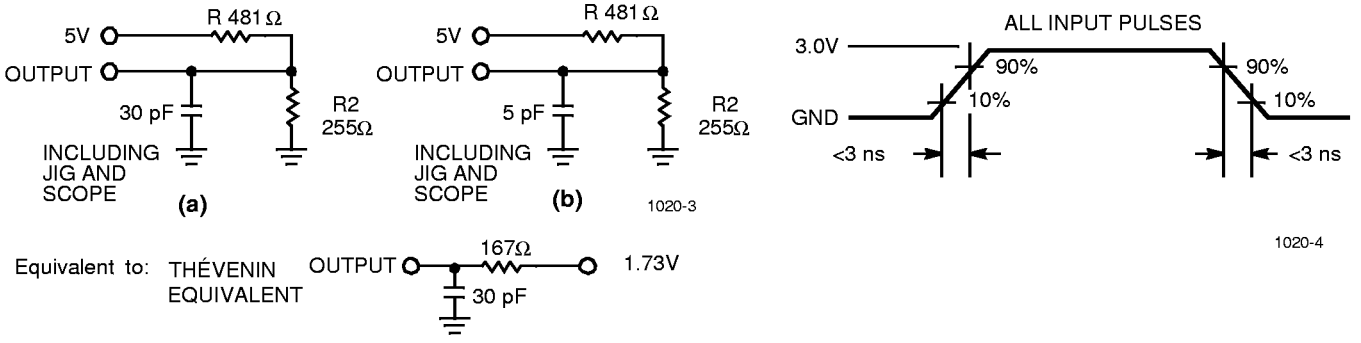
Parameter	Description	Test Conditions		7C1020-20 Min.	7C1020-20 Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = –4.0 mA		2.4		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL} = 8.0 mA			0.4	V
V_{IH}	Input HIGH Voltage			2.2	6.0	V
V_{IL}	Input LOW Voltage[1]			–0.5	0.8	V
I_{IX}	Input Load Current	GND ≤ V_I ≤ V_{CC}		–1	+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_I ≤ V_{CC}, Output Disabled		–2	+2	µA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., I_{OUT} = 0 mA, f = f_{MAX} = $1/t_{RC}$			160	mA
			L		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}			20	mA
			L		10	
I_{SB2}	Automatic CE Power-Down Current —CMOS Inputs	Max. V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3V, V_{IN} ≥ V_{CC} – 0.3V, or V_{IN} ≤ 0.3V, f = 0			3	mA
			L		100	µA

Capacitance[3]

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

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

AC Test Loads and Waveforms



Switching Characteristics[4] Over the Operating Range

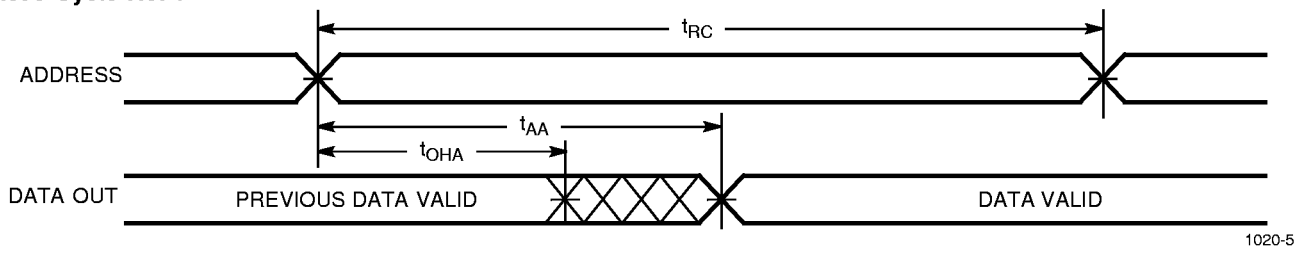
Parameter	Description	7C1020-10		7C1020-12		7C1020-15		7C1020-20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE										
t_{RC}	Read Cycle Time	10		12		15		20		ns
t_{AA}	Address to Data Valid		10		12		15		20	ns
t_{OHA}	Data Hold from Address Change	3		3		3		3		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		10		12		15		20	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		5		5		7		9	ns
t_{LZOE}	$\overline{OE}$ LOW to Low Z	0		0		0		0		ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[5, 6]		5		6		7		8	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[6]	3		3		3		3		ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z[5, 6]		5		6		7		8	ns
t_{PU}	$\overline{CE}$ LOW to Power-Up	0		0		0		0		ns
t_{PD}	$\overline{CE}$ HIGH to Power-Down		12		12		15		20	ns
t_{DBE}	Byte enable to Data Valid		5		6		7		9	ns
t_{LZBE}	Byte enable to Low Z	0		0		0		0		ns
t_{HZBE}	Byte disable to High Z		5		6		7		9	ns
WRITE CYCLE[7]										
t_{WC}	Write Cycle Time	10		12		15		12		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	8		9		10		12		ns
t_{AW}	Address Set-Up to Write End	7		8		10		12		ns
t_{HA}	Address Hold from Write End	0		0		0		0		ns
t_{SA}	Address Set-Up to Write Start	0		0		0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	7		8		10		12		ns
t_{SD}	Data Set-Up to Write End	5		6		10		10		ns
t_{HD}	Data Hold from Write End	0		0		0		0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[6]	3		3		3		3		ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[5, 6]		5		6		7		9	ns
t_{BW}	Byte enable to end of write	7		8		9		12		ns

Notes:

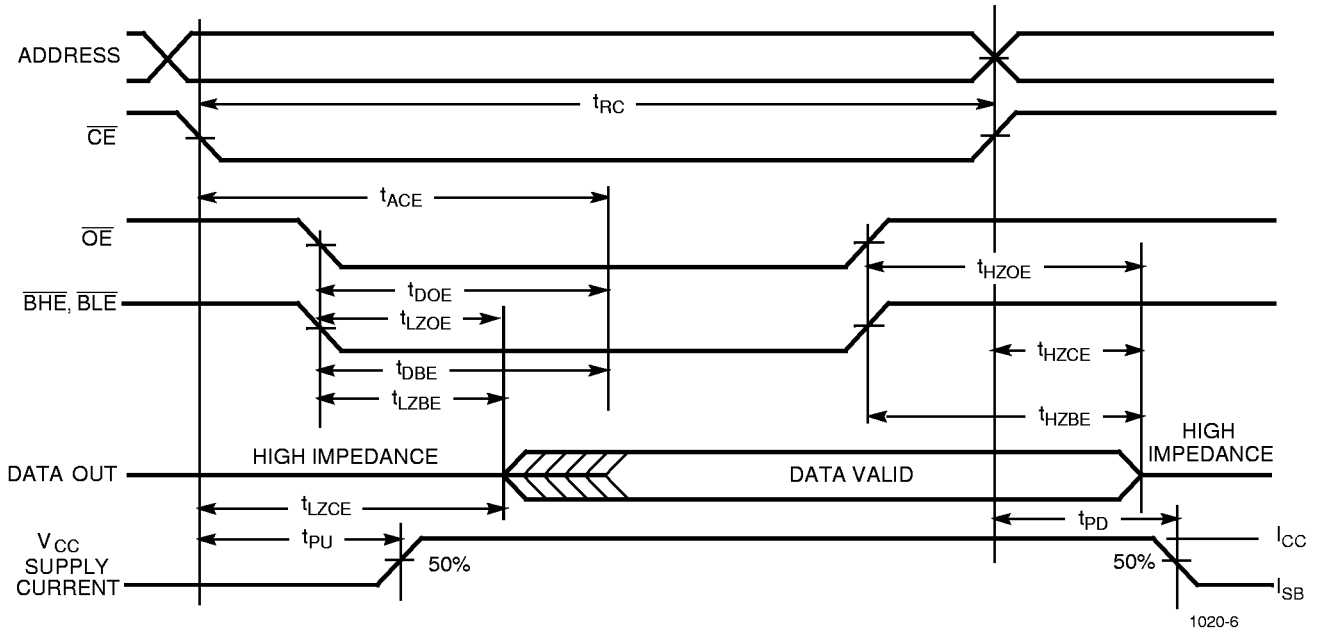
4. Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
5. t_{HZOE}, t_{HZBE}, t_{HZCE}, and t_{HZWE} are specified with a load capacitance of 5 pF as in part (b) of AC Test Loads. Transition is measured ±500 mV from steady-state voltage.
6. 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.
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 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 [8, 9]



Read Cycle No. 2 ($\overline{OE}$ Controlled) [9, 10]

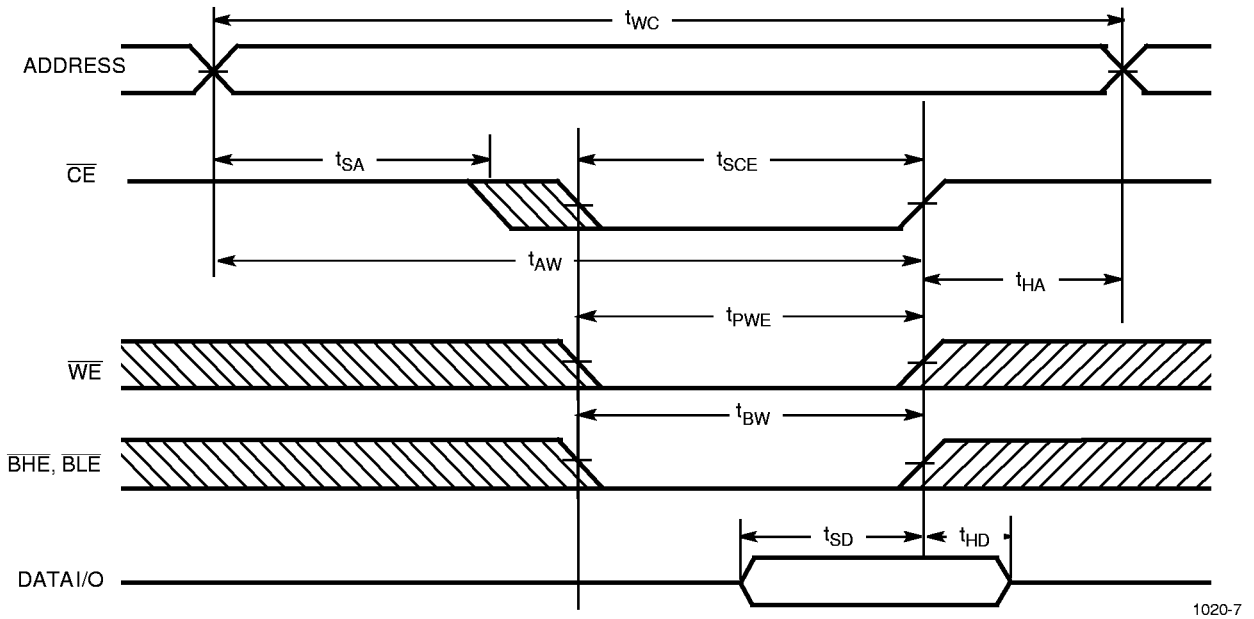


Notes:

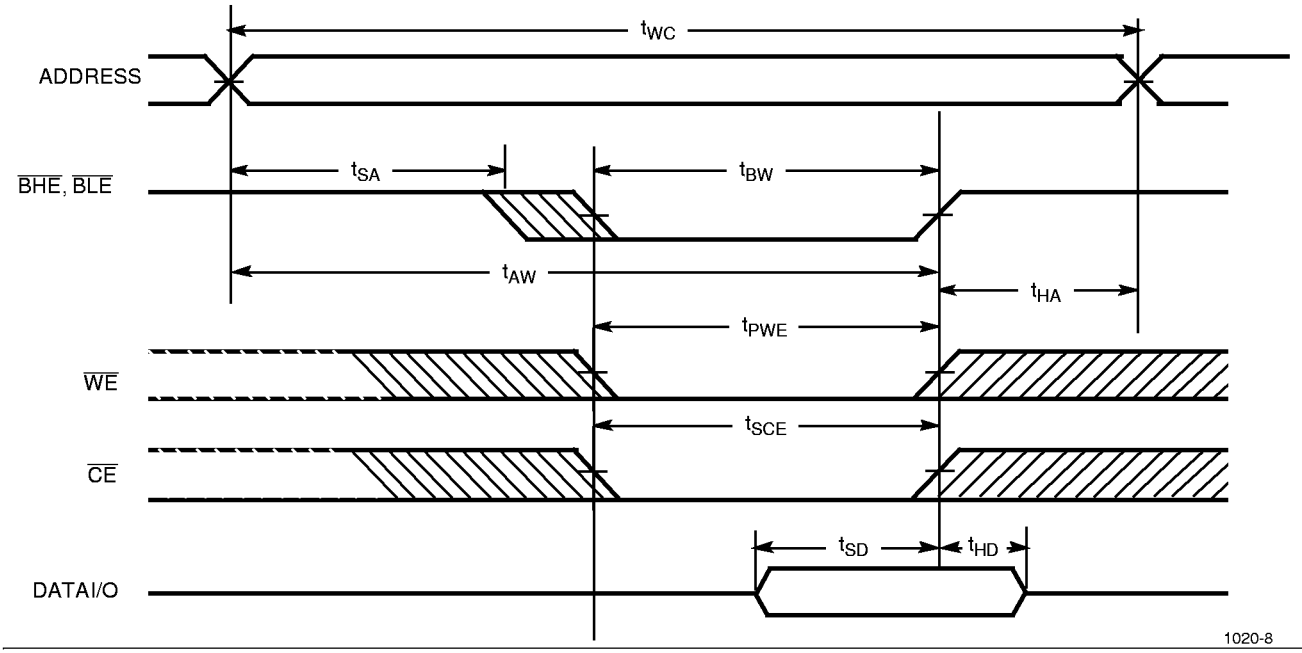
8. Device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{BHE}$ and/or $\overline{BHE} = V_{IL}$.
9. $\overline{WE}$ is HIGH for read cycle.
10. Address valid prior to or coincident with $\overline{CE}$ transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 ($\overline{CE}$ Controlled) [11, 12]



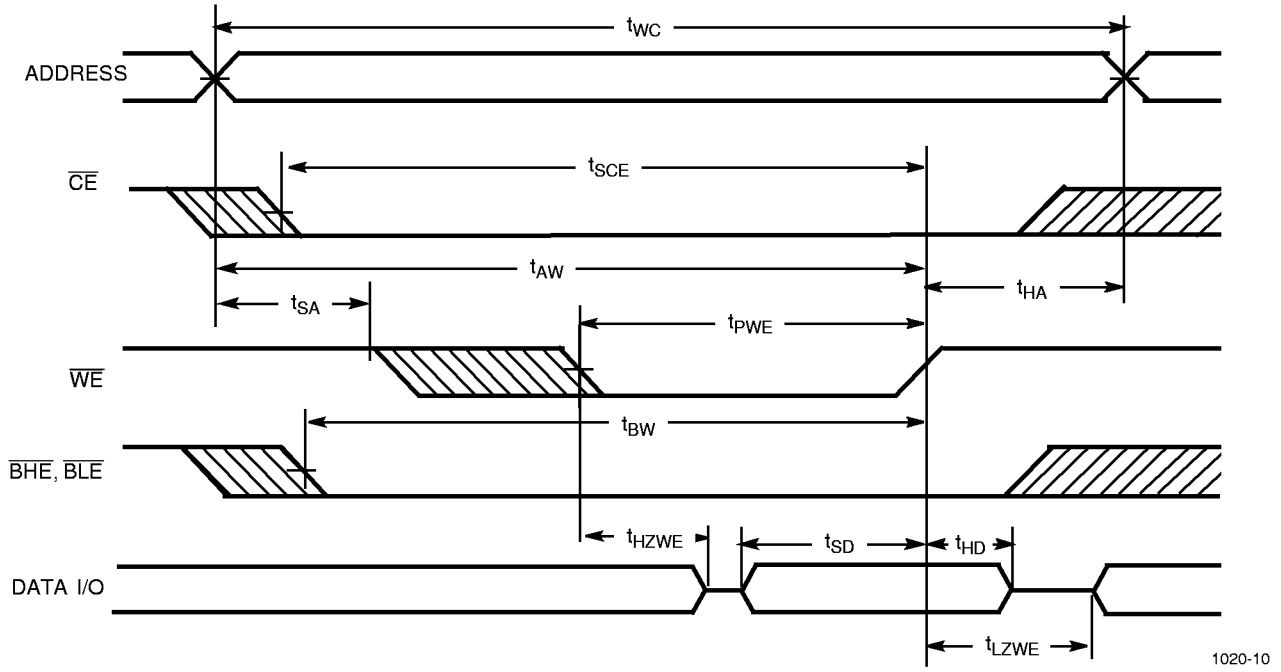
Write Cycle No. 2 ($\overline{BLE}$ or $\overline{BHE}$ Controlled)



Notes:
11. Data I/O is high impedance if $\overline{OE}$ or $\overline{BHE}$ and/or $\overline{BLE}$= V_{IH}.
12. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ 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 Name	Package Type	Operating Range
10	CY7C1020-10VC	V34	44-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1020L-10VC	V34	44-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1020-10ZC	Z44	44-Lead TSOP Type II	Commercial
	CY7C1020L-10ZC	Z44	44-Lead TSOP Type II	Commercial
12	CY7C1020-12VC	V34	44-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1020L-12VC	V34	44-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1020-12ZC	Z44	44-Lead TSOP Type II	Commercial
	CY7C1020L-12ZC	Z44	44-Lead TSOP Type II	Commercial
15	CY7C1020-15VC	V34	44-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1020L-15VC	V34	44-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1020-15ZC	Z44	44-Lead TSOP Type II	Commercial
	CY7C1020L-15ZC	Z44	44-Lead TSOP Type II	Commercial
20	CY7C1020-20VC	V34	44-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1020L-20VC	V34	44-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1020-20ZC	Z44	44-Lead TSOP Type II	Commercial
	CY7C1020L-20ZC	Z44	44-Lead TSOP Type II	Commercial

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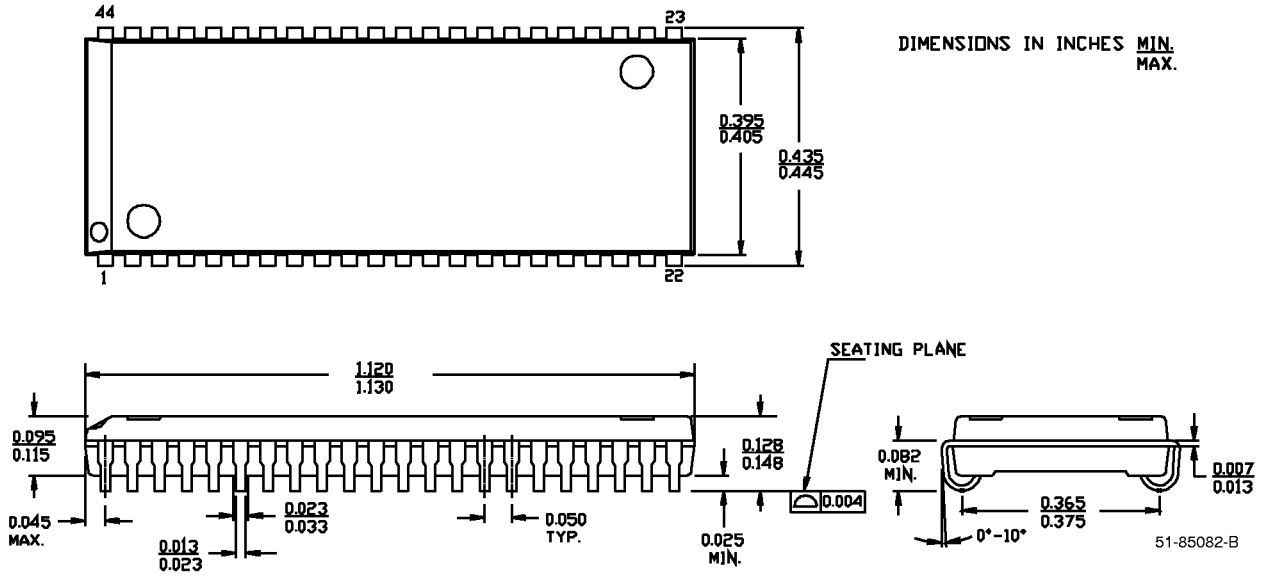
Package Diagrams

44-Lead (400-Mil) Molded SOJ V34



Package Diagrams (continued)

44-Pin TSOP II Z44