



64K x 16 Static RAM

Features

- 3.3V operation (3.0V–3.6V)
- High speed
 - $t_{AA} = 10/12/15$ ns
- CMOS for optimum speed/power
- Low Active Power (L version)
 - 576 mW (max.)
- Low CMOS Standby Power (L version)
 - 1.80 mW (max.)
- Automatic power-down when deselected
- Independent control of upper and lower bits
- Available in 44-pin TSOP II and 400-mil SOJ
- Available in a 48-Ball Mini BGA package

Functional Description

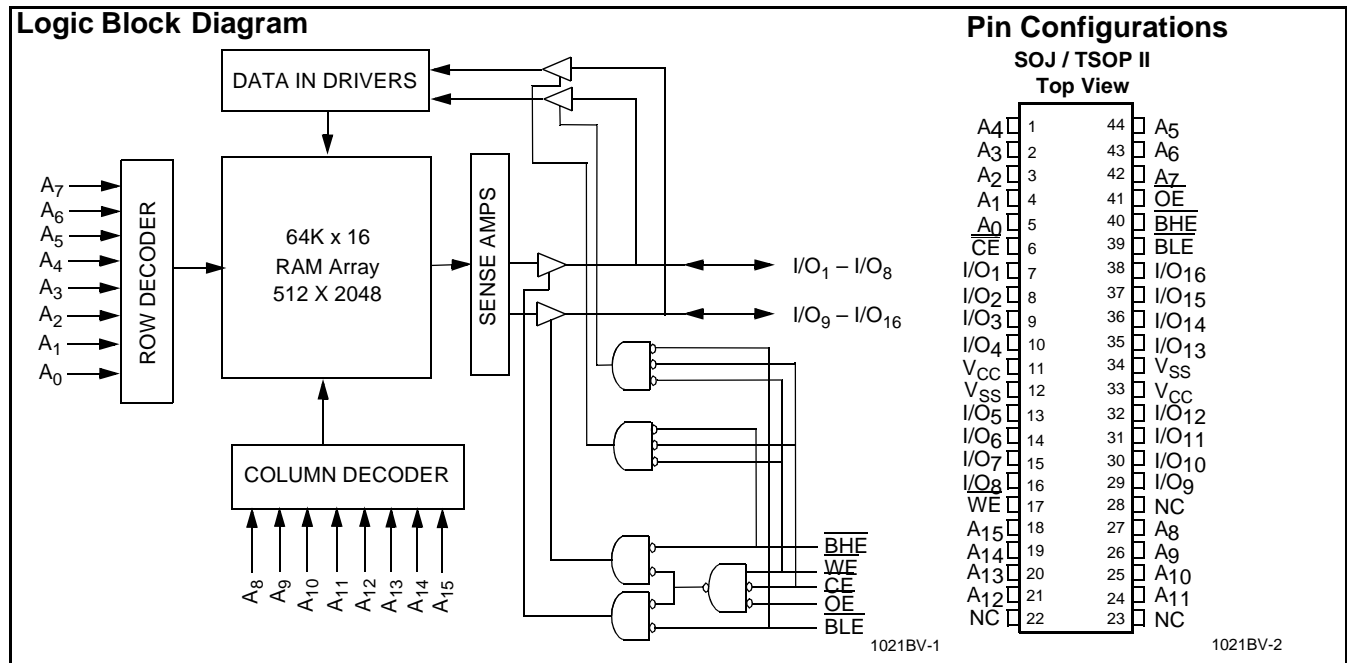
The CY7C1021BV is a high-performance CMOS static RAM organized as 65,536 words by 16 bits. This device has an automatic power-down feature that significantly reduces power consumption when deselected.

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).

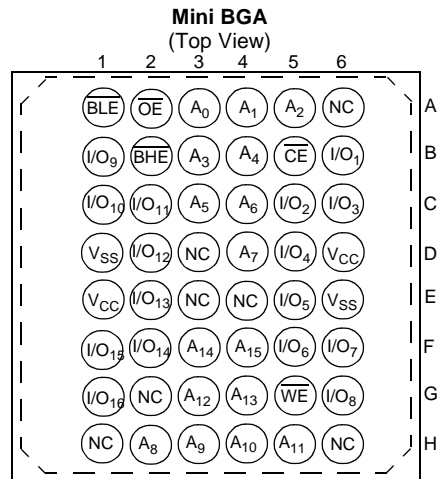
The CY7C1021BV is available in 400-mil-wide SOJ, standard 44-pin TSOP Type II, and 48-ball mini BGA packages.



Selection Guide

		7C1021BV-8	7C1021BV-10	7C1021BV-12	7C1021BV-15
Maximum Access Time (ns)		8	10	12	15
Maximum Operating Current (mA)	Commercial	170	160	150	140
	Industrial	190	180	170	160
Maximum CMOS Standby Current (mA)	Commercial	5	5	5	5
	L	0.500	0.500	0.500	0.500

Shaded areas contain advance information.

Pin Configurations

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

Notes:

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

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	3.3V ± 10%
Industrial	-40°C to +85°C	3.3V ± 10%

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	7C1021BV-8		7C1021BV-10		7C1021BV-12		7C1021BV-15		Unit	
			Min.	Max.	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		2.4		V	
V _{OL}	Output LOW Voltage	V _{CC} = Min., I _{OL} = 8.0 mA		0.4		0.4		0.4		0.4	V	
V _{IH}	Input HIGH Voltage		2.2	V _{CC} + 0.3V	2.2	V _{CC} + 0.3V	2.2	V _{CC} + 0.3V	2.2	V _{CC} + 0.3V	V	
V _{IL}	Input LOW Voltage ^[1]		-0.3	0.8	-0.3	0.8	-0.3	0.8	-0.3	0.8	V	
I _{IX}	Input Load Current	GND ≤ V _I ≤ V _{CC}	-1	+1	-1	+1	-1	+1	-1	+1	μA	
I _{OZ}	Output Leakage Current	GND ≤ V _I ≤ V _{CC} , Output Disabled	-1	+1	-1	+1	-1	+1	-1	+1	μA	
I _{CC}	V _{CC} Operating Supply Current	V _{CC} = Max., I _{OUT} = 0 mA, f = f _{MAX} = 1/t _{RC}	C		170		160		150		140	mA
			o									
				190		120		170		160	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}		40		40		40		40	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		5		5		5		5	mA	
			L	500		500		500		500	μA	

Shaded areas contain advance information.

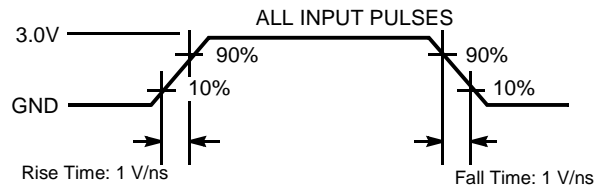
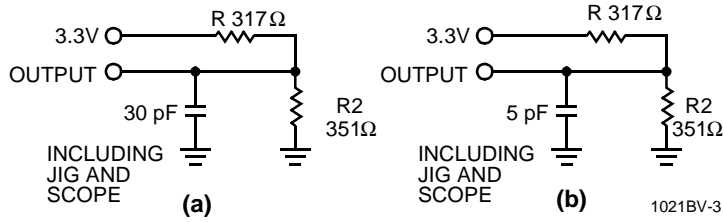
Capacitance^[3]

Parameter	Description	Test Conditions	Max.	Unit
C _{IN}	Input Capacitance	T _A = 25°C, f = 1 MHz	6	pF
C _{OUT}	Output Capacitance		8	pF

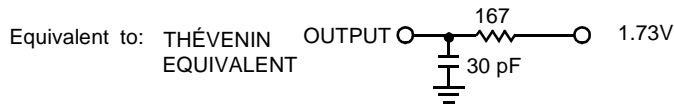
Note:

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

AC Test Loads and Waveforms



1021BV-4



Switching Characteristics^[4] Over the Operating Range

Parameter	Description	7C1021BV-8		7C1021BV-10		7C1021BV-12		7C1021BV-15		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE										
t _{RC}	Read Cycle Time	8		10		12		15		ns
t _{AA}	Address to Data Valid		8		10		12		15	ns
t _{OHA}	Data Hold from Address Change	3		3		3		3		ns
t _{ACE}	\overline{CE} LOW to Data Valid		8		10		12		15	ns
t _{DOE}	\overline{OE} LOW to Data Valid		4		4		6		7	ns
t _{LZOE}	\overline{OE} LOW to Low Z	0		0		0		0		ns
t _{HZOE}	\overline{OE} HIGH to High Z ^[5, 6]		4		5		6		7	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]		4		5		6		7	ns
t _{PU}	\overline{CE} LOW to Power-Up	0		0		0		0		ns
t _{PD}	\overline{CE} HIGH to Power-Down		12		12		12		15	ns
t _{DBE}	Byte Enable to Data Valid	4		5		6		7		ns
t _{LZBE}	Byte Enable to Low Z	0		0		0		0		ns
t _{HZBE}	Byte Disable to High Z		4		5		6		7	ns
WRITE CYCLE^[7]										
t _{WC}	Write Cycle Time	8		10		12		15		ns
t _{SCE}	\overline{CE} LOW to Write End	7		8		9		10		ns
t _{AW}	Address Set-Up to Write End	6		7		8		10		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	6		8		8		10		ns
t _{SD}	Data Set-Up to Write End	4		6		6		8		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]		4		5		6		7	ns
t _{BW}	Byte Enable to End of Write	8		8		8		9		ns

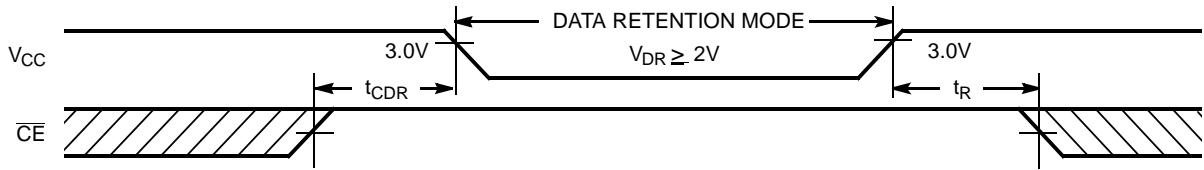
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Data Retention Characteristics Over the Operating Range (L version only)

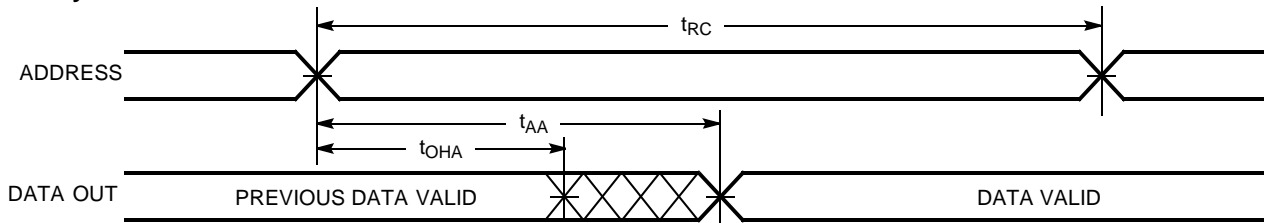
Parameter	Description		Conditions ^[8]	Min.	Max.	Unit
V _{DR}	V _{CC} for Data Retention			2.0		V
I _{CCDR}	Data Retention Current	Com'l	V _{CC} = V _{DR} = 2.0V, CE ≥ V _{CC} - 0.3V, V _{IN} ≥ V _{CC} - 0.3V or V _{IN} ≤ 0.3V		100	μA
t _{CDR} ^[9]	Chip Deselect to Data Retention Time			0		ns
t _R ^[10]	Operation Recovery Time			t _{RC}		ns

Notes:

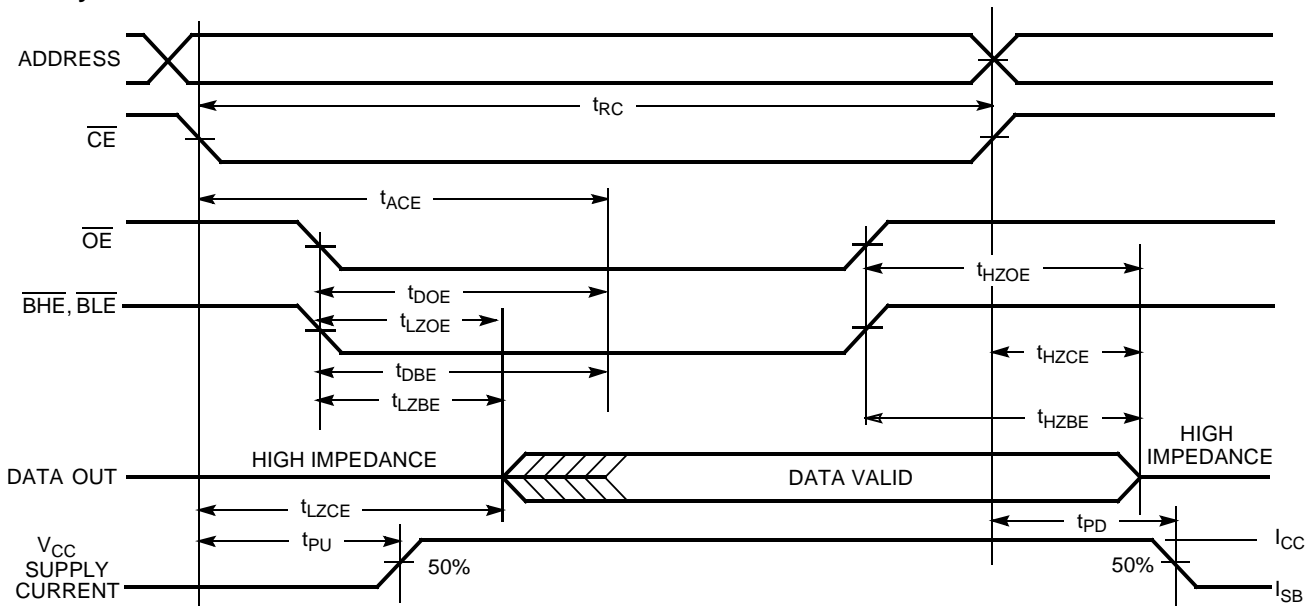
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- t_{HZOE}, t_{HZBE}, t_{HZCE}, and t_{HZWE} are specified with a load capacitance of 5 pF as in part (b) of AC Test Loads. Transition is measured ±500 mV from steady-state voltage.
- 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.
- The internal write time of the memory is defined by the overlap of CE LOW, WE LOW and BHE / BLE LOW. CE, WE and BHE / 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.
- No input may exceed V_{CC} + 0.5V.
- Tested initially and after any design or process changes that may affect these parameters.
- t_r ≤ 3 ns for the -12 and -15 speeds. t_r ≤ 5 ns for the -20 and slower speeds.

Data Retention Waveform


1021BV-5

Switching Waveforms
Read Cycle No. 1 ^[11, 12]


1021BV-6

Read Cycle No. 2 (\overline{OE} Controlled) ^[12, 13]


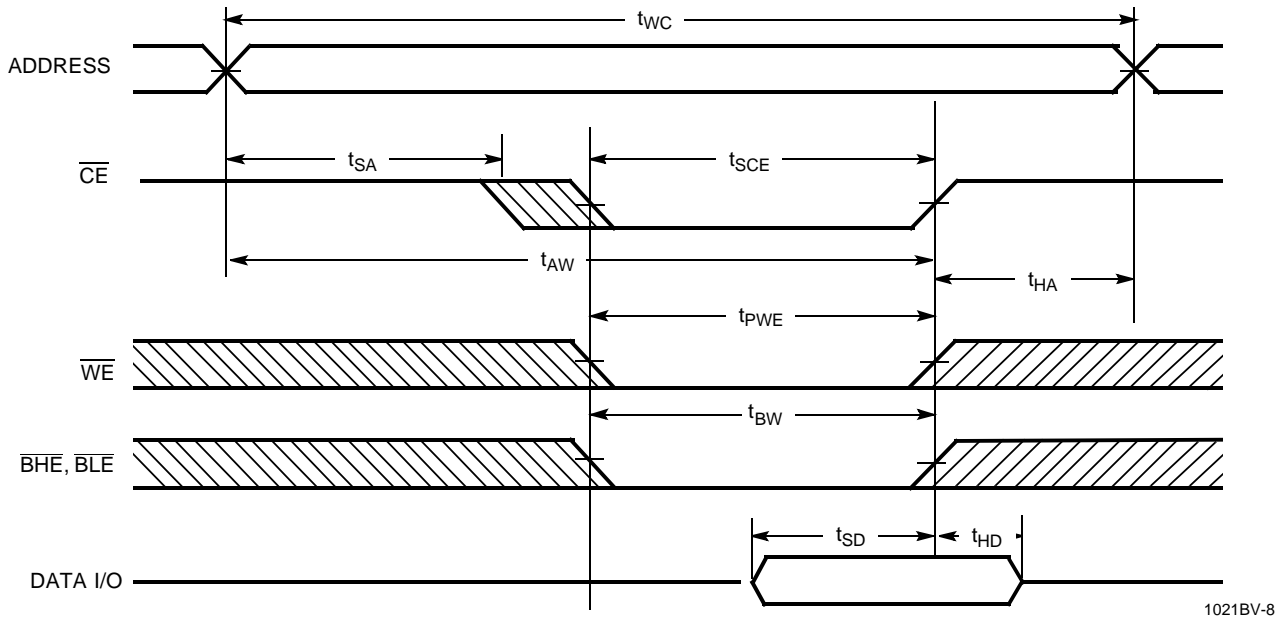
1021BV-7

Notes:

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

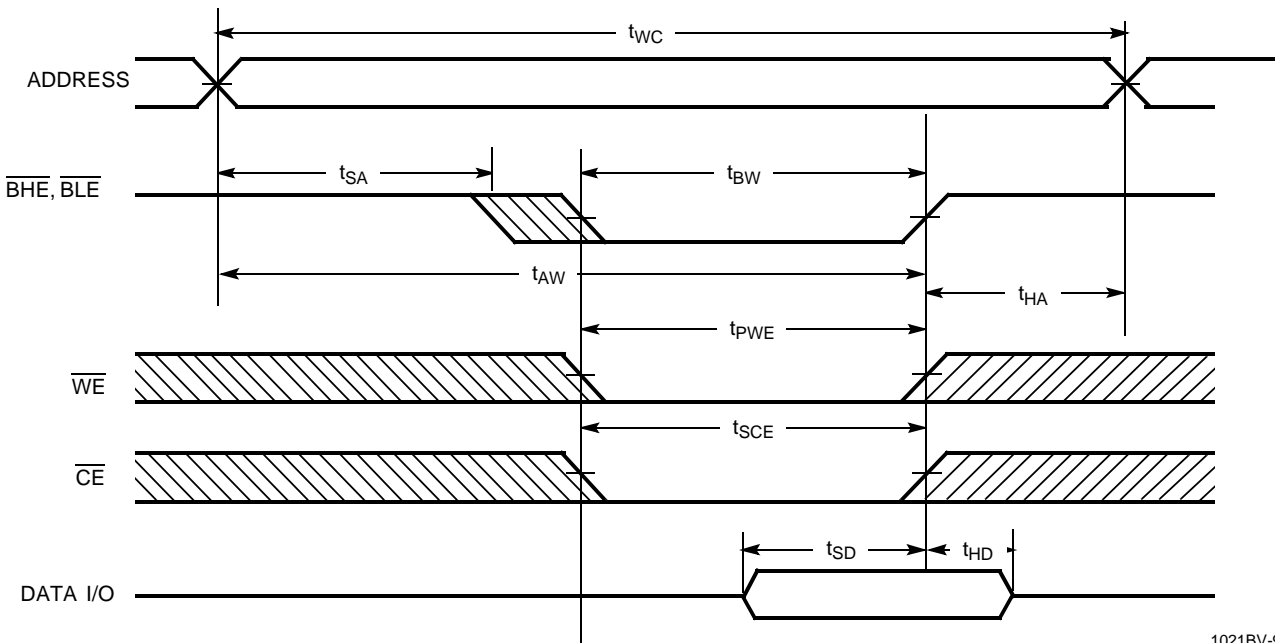
Switching Waveforms (continued)

Write Cycle No. 1 ($\overline{\text{CE}}$ Controlled) ^[14, 15]



1021BV-8

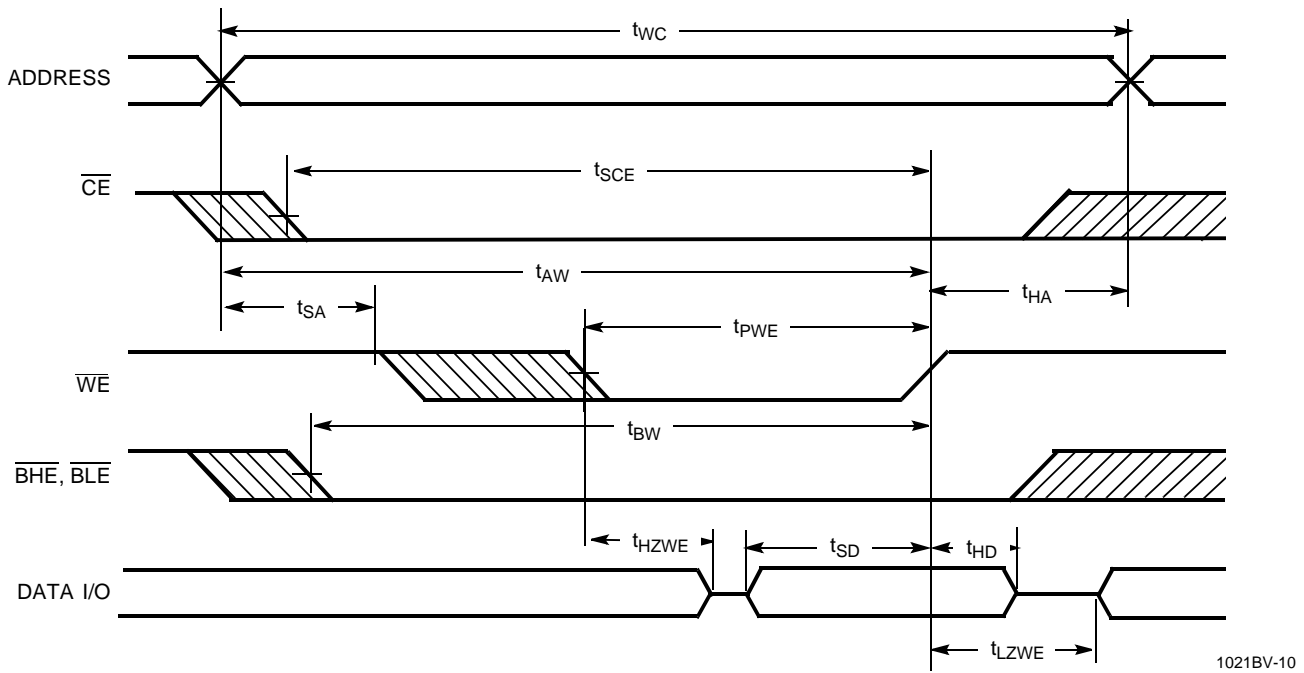
Write Cycle No. 2 ($\overline{\text{BLE}}$ or $\overline{\text{BHE}}$ Controlled)



1021BV-9

Notes:

- 14. Data I/O is high impedance if $\overline{\text{OE}}$ or $\overline{\text{BHE}}$ and/or $\overline{\text{BLE}} = V_{IH}$.
- 15. 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, 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})

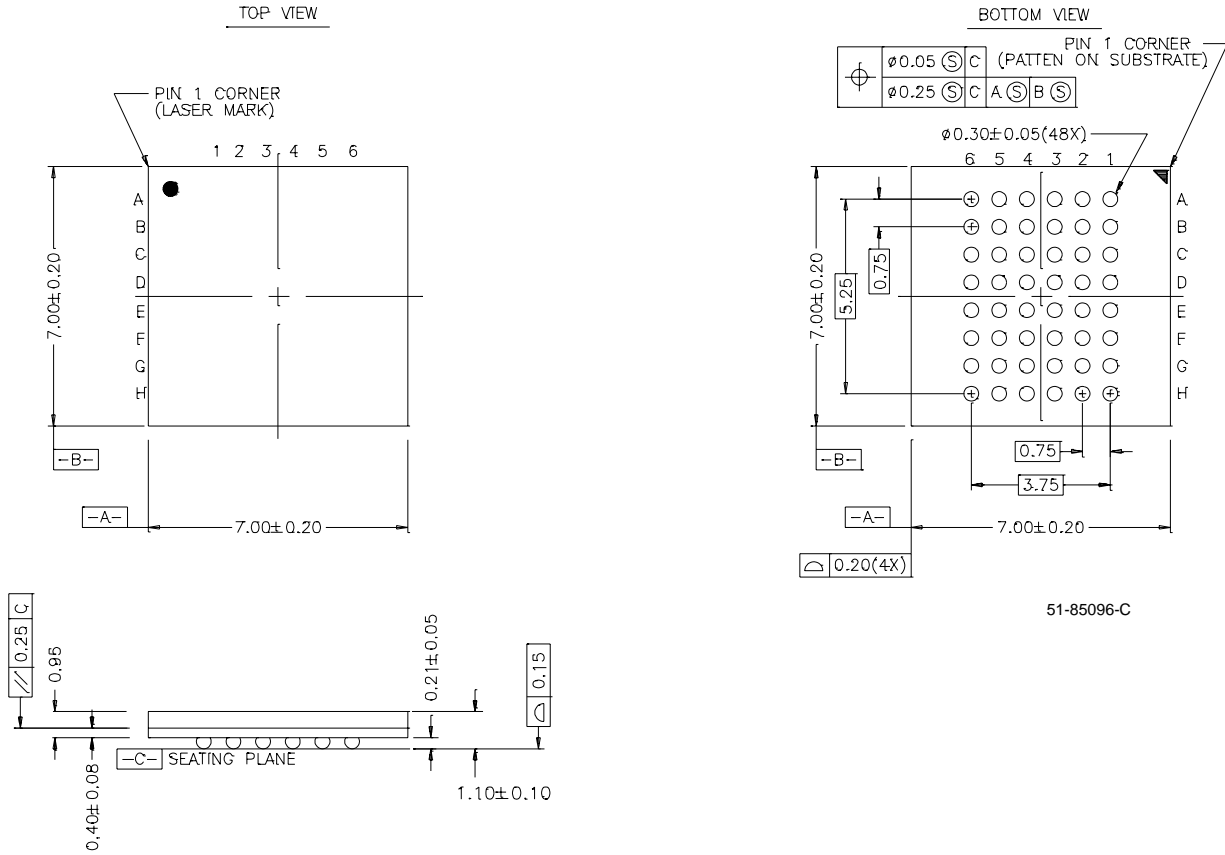
Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
8	CY7C1021BV33-8BAC	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	Commercial
	CY7C1021BV33-8VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021BV33L-8VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021BV33-8ZC	Z44	44-Lead TSOP Type II	
	CY7C1021BV33L-8ZC	Z44	44-Lead TSOP Type II	
10	CY7C1021BV33-10BAC	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	Commercial
	CY7C1021BV33-10VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021BV33L-10VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021BV33-10ZC	Z44	44-Lead TSOP Type II	
	CY7C1021BV33L-10ZC	Z44	44-Lead TSOP Type II	
12	CY7C1021BV33-12BAC	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	Commercial
	CY7C1021BV33-12VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021BV33L-12VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021BV33-12ZC	Z44	44-Lead TSOP Type II	
	CY7C1021BV33L-12ZC	Z44	44-Lead TSOP Type II	
	CY7C1021BV33-12BAI	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	Industrial
	CY7C1021BV33-12VI	V34	44-Lead (400-Mil) Molded SOJ	
15	CY7C1021BV33-15BAC	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	Commercial
	CY7C1021BV33L-15BAC	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	
	CY7C1021BV33-15VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021BV33L-15VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021BV33-15ZC	Z44	44-Lead TSOP Type II	
	CY7C1021BV33L-15VC	Z44	44-Lead TSOP Type II	
	CY7C1021BV33-15BAI	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	Industrial
	CY7C1021BV33L-15BAI	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	
	CY7C1021BV33-15VI	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021BV33L-15ZI	Z44	44-Lead TSOP Type II	

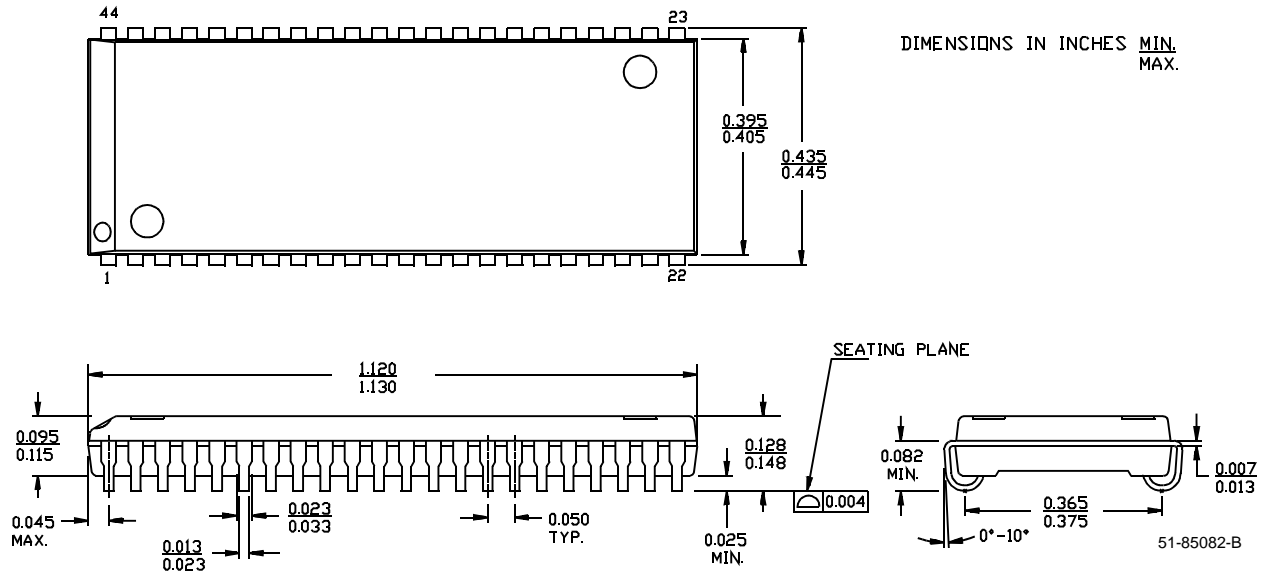
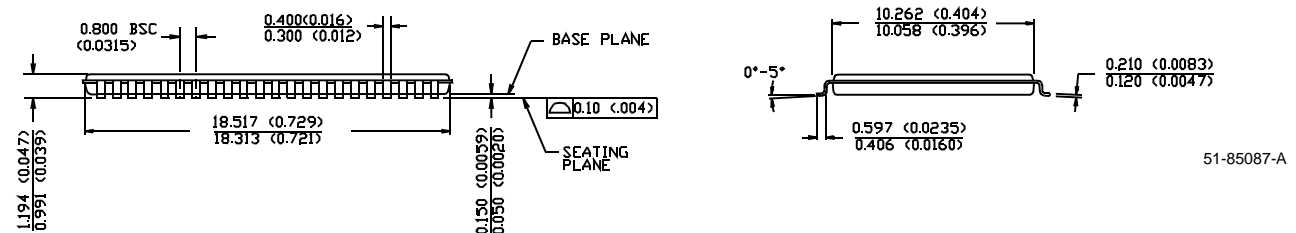
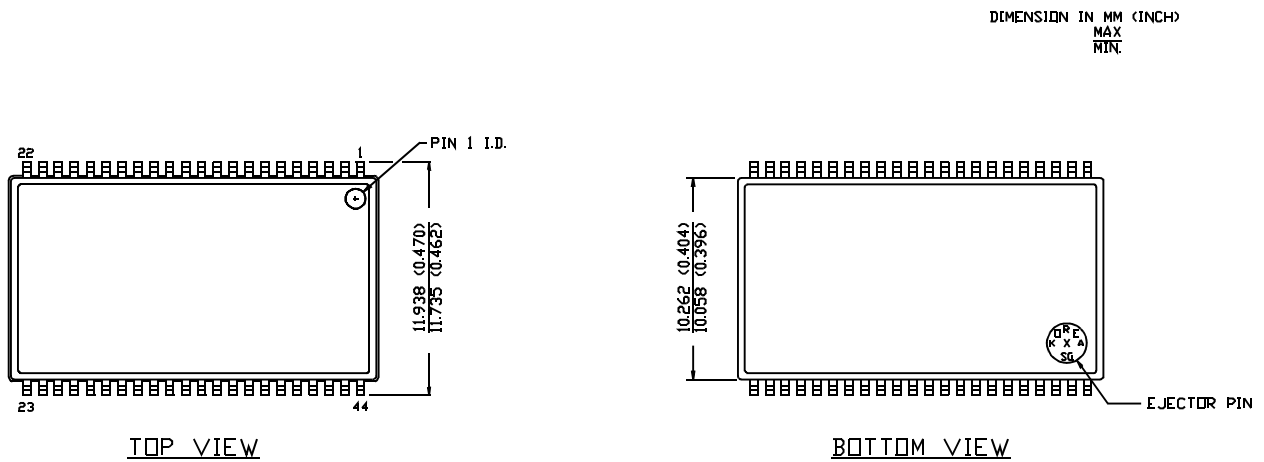
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Package Diagrams

48-Ball (7.00 mm x 7.00 mm) FBGA BA48



51-85096-C

Package Diagrams (continued)
44-Lead (400-Mil) Molded SOJ V34

44-Pin TSOP II Z44




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REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	109892	09/22/01	SZV	Change from Spec number: 38-00954 to 38-05148