

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

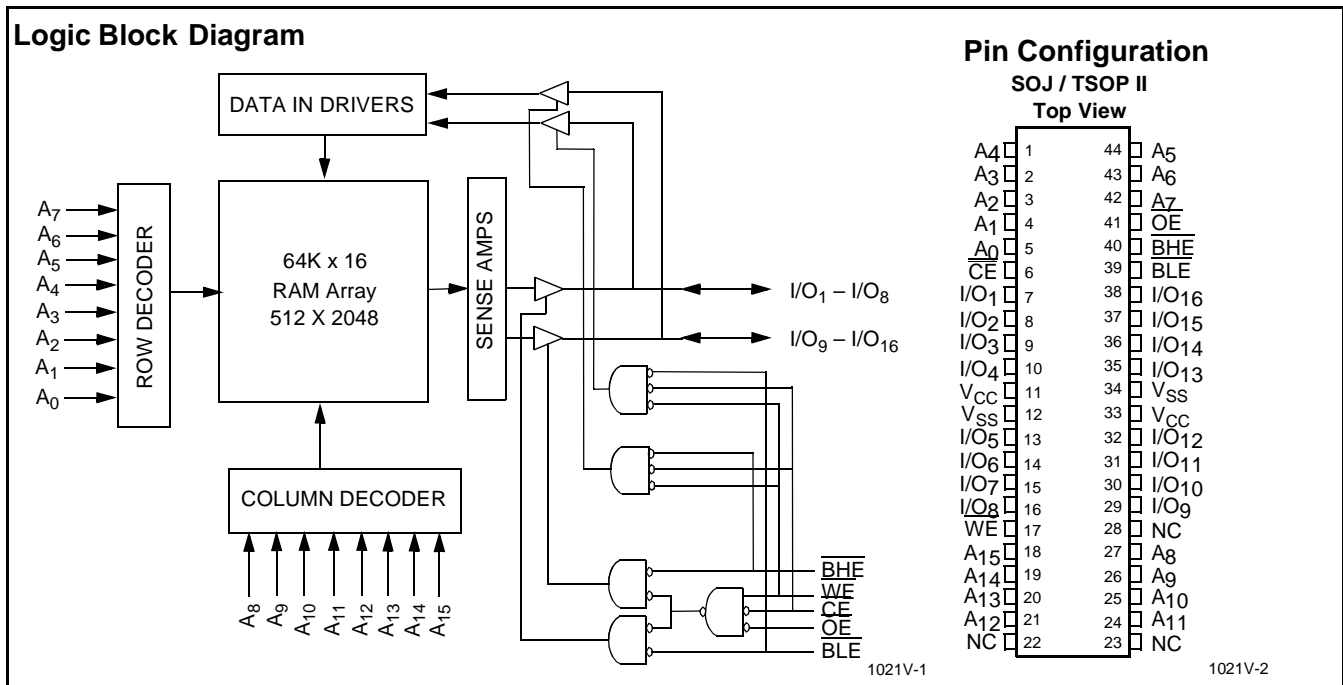
The CY7C1021V is a high-performance CMOS static RAM organized as 65,536 words by 16 bits. This device has an automatic power-down feature that significantly reduces power consumption when deselected.

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.

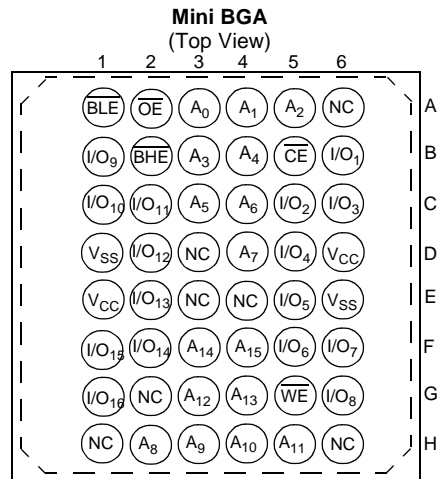
The input/output pins (I/O_1 through I/O_{16}) are placed in a high-impedance state when the device is deselected (\overline{CE} HIGH), the outputs are disabled (\overline{OE} HIGH), the \overline{BHE} and \overline{BLE} are disabled (\overline{BHE} , \overline{BLE} HIGH), or during a write operation (\overline{CE} LOW, and \overline{WE} LOW).

The CY7C1021V is available in 400-mil-wide SOJ, standard 44-pin TSOP Type II, and in 48-ball mini BGA packages.



Selection Guide

		7C1021V-10	7C1021V-12	7C1021V-15
Maximum Access Time (ns)		10	12	15
Maximum Operating Current (mA)	Commercial	210	200	190
	L	160	150	140
Maximum CMOS Standby Current (mA)	Commercial	5	5	5
	L	0.500	0.500	0.500

Pin Configurations (continued)

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

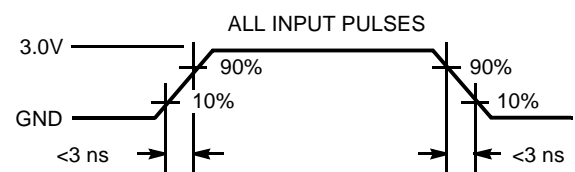
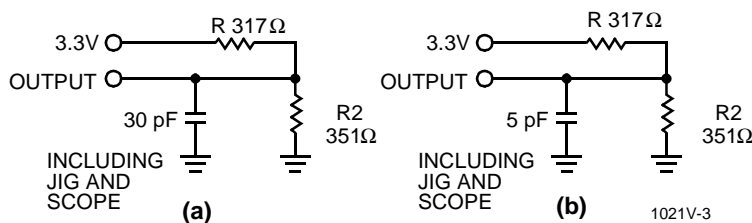
Parameter	Description	Test Conditions	7C1021V-10		7C1021V-12		7C1021V-15		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}, I_{OH} = -4.0 \text{ mA}$	2.4		2.4		2.4		V
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min.}, I_{OL} = 8.0 \text{ mA}$		0.4		0.4		0.4	V
V_{IH}	Input HIGH Voltage		2.2	$V_{CC} + 0.3V$	2.2	$V_{CC} + 0.3V$	2.2	$V_{CC} + 0.3V$	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	$GND \leq V_I \leq V_{CC}$	-1	+1	-1	+1	-1	+1	μA
I_{OZ}	Output Leakage Current	$GND \leq V_I \leq V_{CC},$ Output Disabled	-1	+1	-1	+1	-1	+1	μA
I_{CC}	V_{CC} Operating Supply Current	$V_{CC} = \text{Max.},$ $I_{OUT} = 0 \text{ mA},$ $f = f_{MAX} = 1/t_{RC}$		210		200		190	mA
			L	160		150		140	mA
I_{SB1}	Automatic CE Power-Down Current — TTL Inputs	Max. $V_{CC}, CE \geq V_{IH}$ $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}, f = f_{MAX}$		40		40		40	mA
I_{SB2}	Automatic CE Power-Down Current — CMOS Inputs	Max. $V_{CC},$ $CE \geq V_{CC} - 0.3V,$ $V_{IN} \geq V_{CC} - 0.3V,$ or $V_{IN} \leq 0.3V, f = 0$		5		5		5	mA
			L	500		500		500	μA

Capacitance^[3]

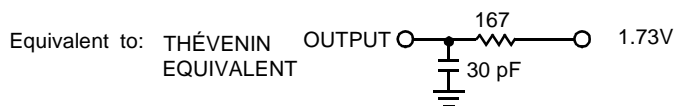
Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	$T_A = 25^\circ\text{C}, f = 1 \text{ MHz}$	6	pF
C_{OUT}	Output Capacitance		8	pF

Note:

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

AC Test Loads and Waveforms


1021V-4



Switching Characteristics^[4] Over the Operating Range

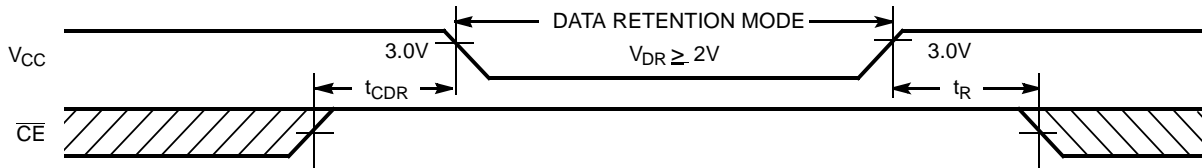
Parameter	Description	7C1021V-10		7C1021V-12		7C1021V-15		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE								
t _{RC}	Read Cycle Time	10		12		15		ns
t _{AA}	Address to Data Valid		10		12		15	ns
t _{OHA}	Data Hold from Address Change	3		3		3		ns
t _{ACE}	CE LOW to Data Valid		10		12		15	ns
t _{DOE}	OE LOW to Data Valid		4		6		7	ns
t _{LZOE}	OE LOW to Low Z	0		0		0		ns
t _{HZOE}	OE HIGH to High Z ^[5, 6]		5		6		7	ns
t _{LZCE}	CE LOW to Low Z ^[6]	3		3		3		ns
t _{HZCE}	CE HIGH to High Z ^[5, 6]		5		6		7	ns
t _{PU}	CE LOW to Power-Up	0		0		0		ns
t _{PD}	CE HIGH to Power-Down		12		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^[7]								
t _{WC}	Write Cycle Time	10		12		15		ns
t _{SCE}	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}	WE Pulse Width	8		8		10		ns
t _{SD}	Data Set-Up to Write End	6		6		8		ns
t _{HD}	Data Hold from Write End	0		0		0		ns
t _{LZWE}	WE HIGH to Low Z ^[6]	3		3		3		ns
t _{HZWE}	WE LOW to High Z ^[5, 6]		5		6		7	ns
t _{BW}	Byte Enable to End of Write	8		8		9		ns

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

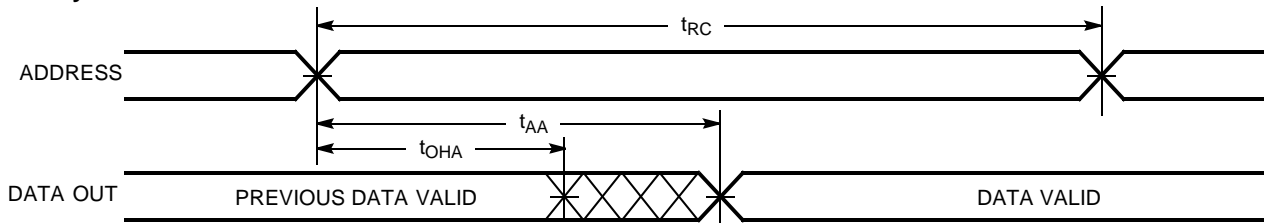
Parameter	Description	Conditions ^[10]	Min.	Max.	Unit
V _{DR}	V _{CC} for Data Retention		2.0		V
I _{CCDR}	Data Retention Current	Com'l		100	μA
t _{CDR} ^[8]	Chip Deselect to Data Retention Time		0		ns
t _R ^[9]	Operation Recovery Time		t _{RC}		ns

Notes:

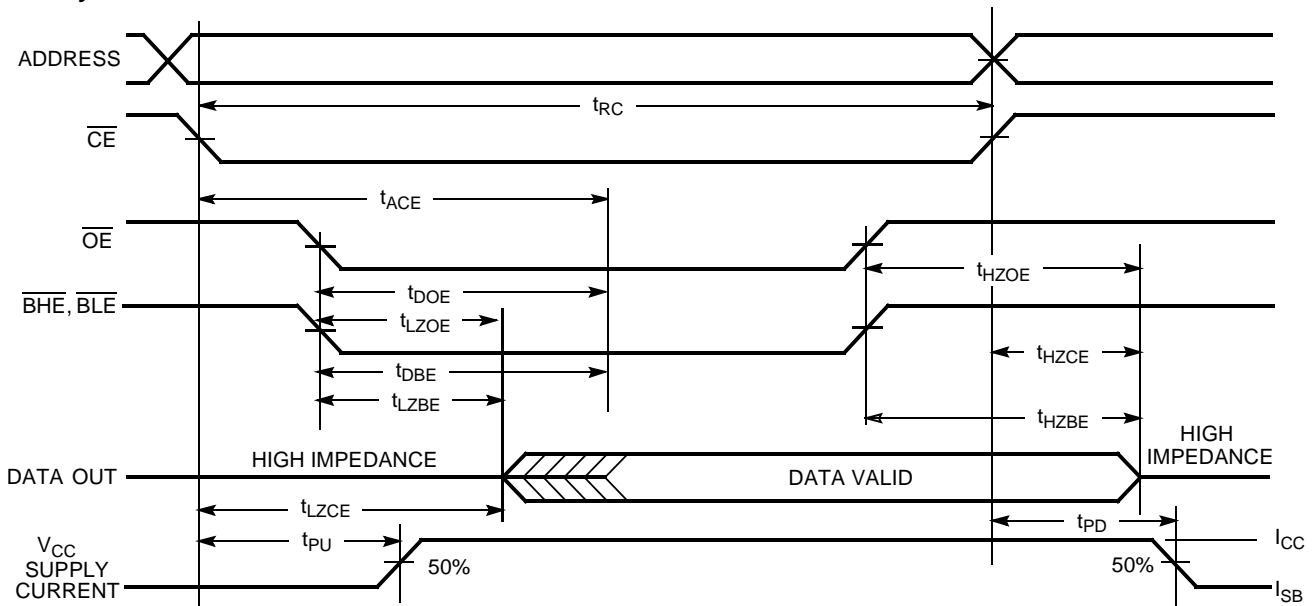
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- t_{HZOE}, t_{HZBE}, t_{HZCE}, and t_{HZWE} are specified with a load capacitance of 5 pF as 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.
- 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.
- No input may exceed V_{CC} + 0.5V.

Data Retention Waveform


1021V-5

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


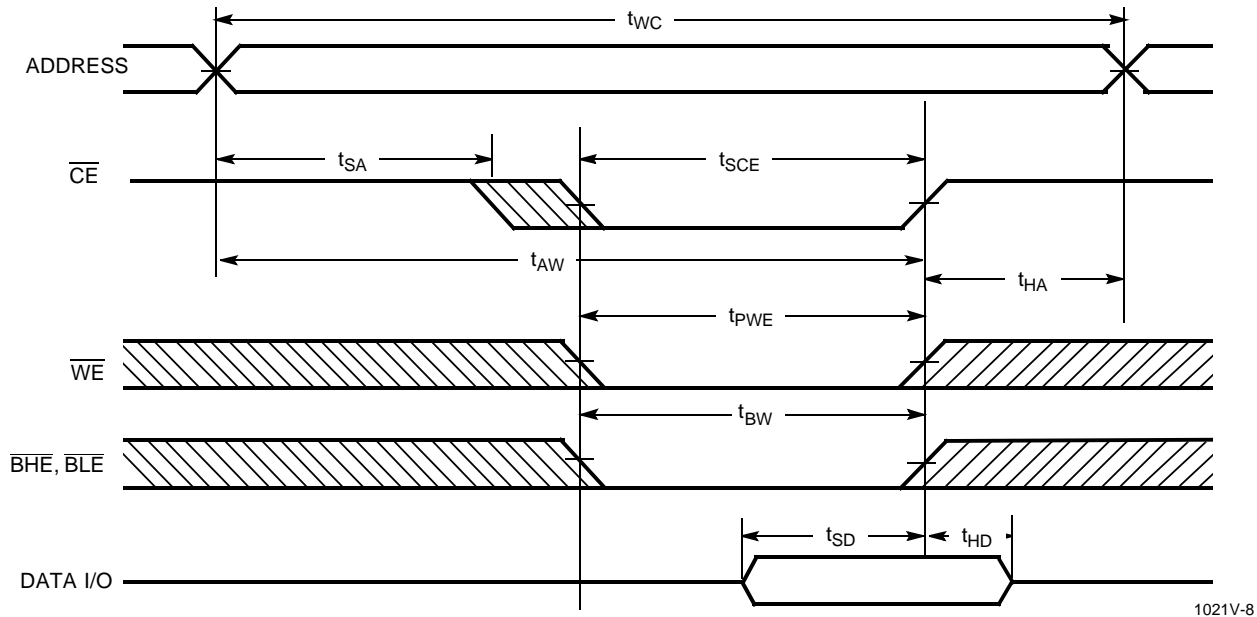
1021V-6

Read Cycle No. 2 (OE Controlled) ^[12, 13]


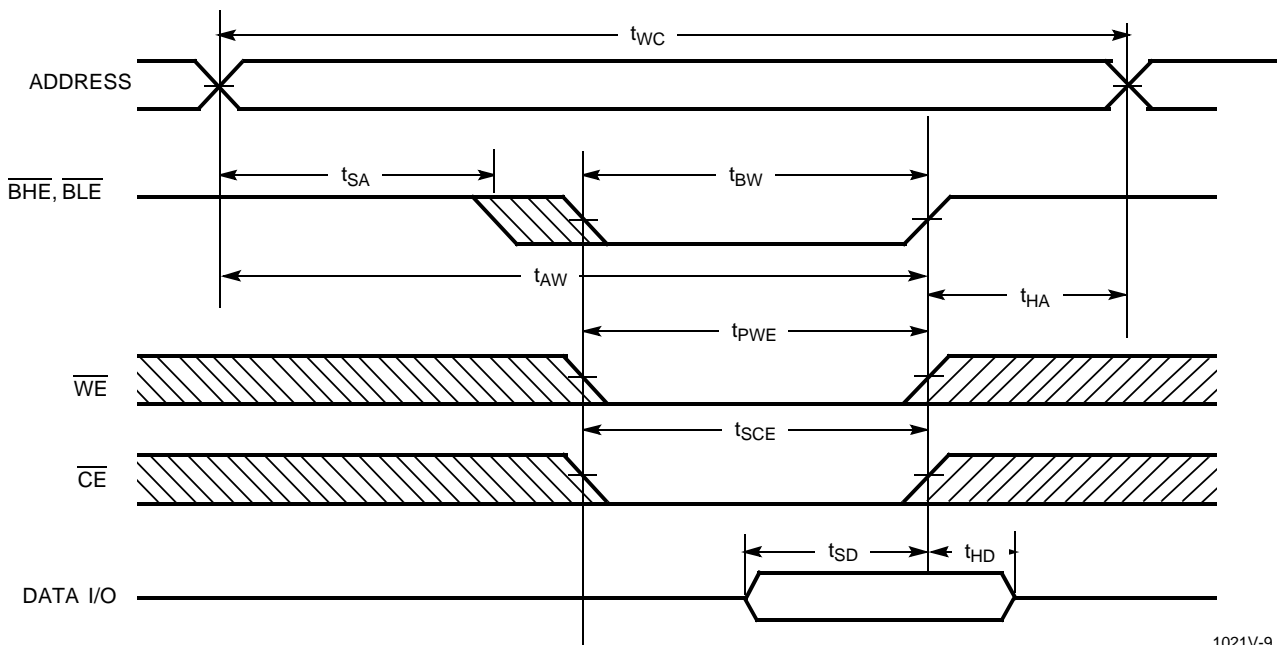
1021V-7

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]


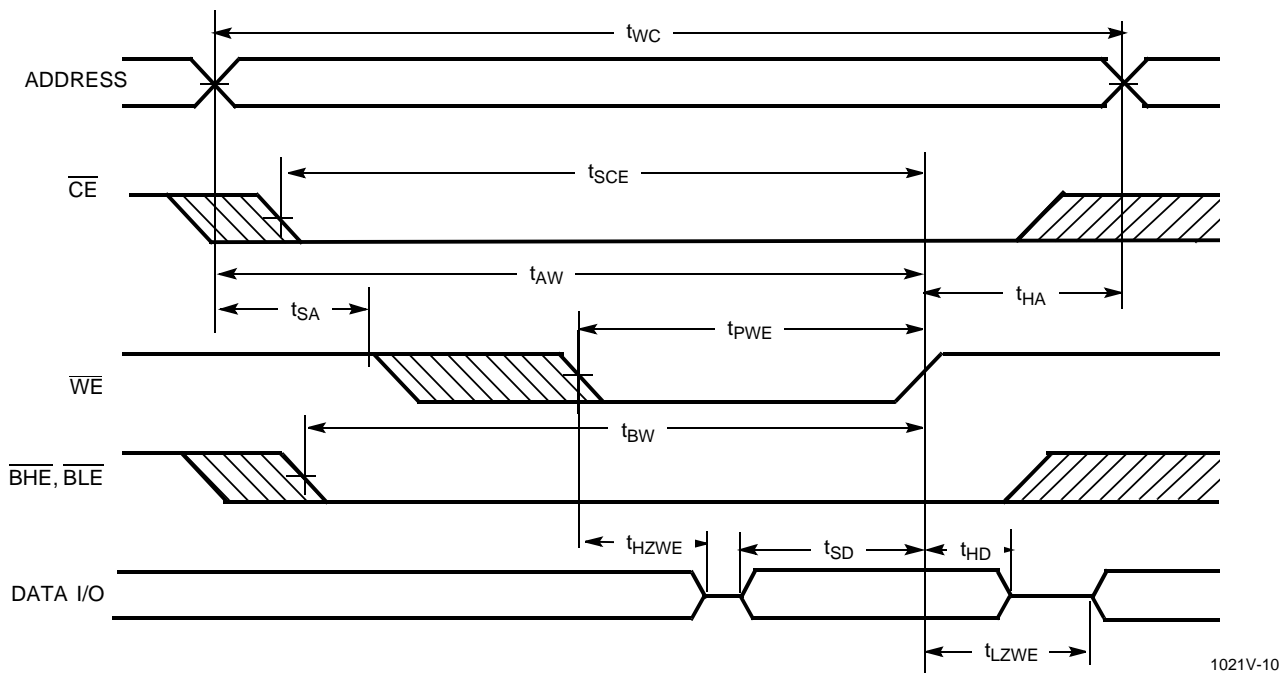
1021V-8

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


1021V-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)


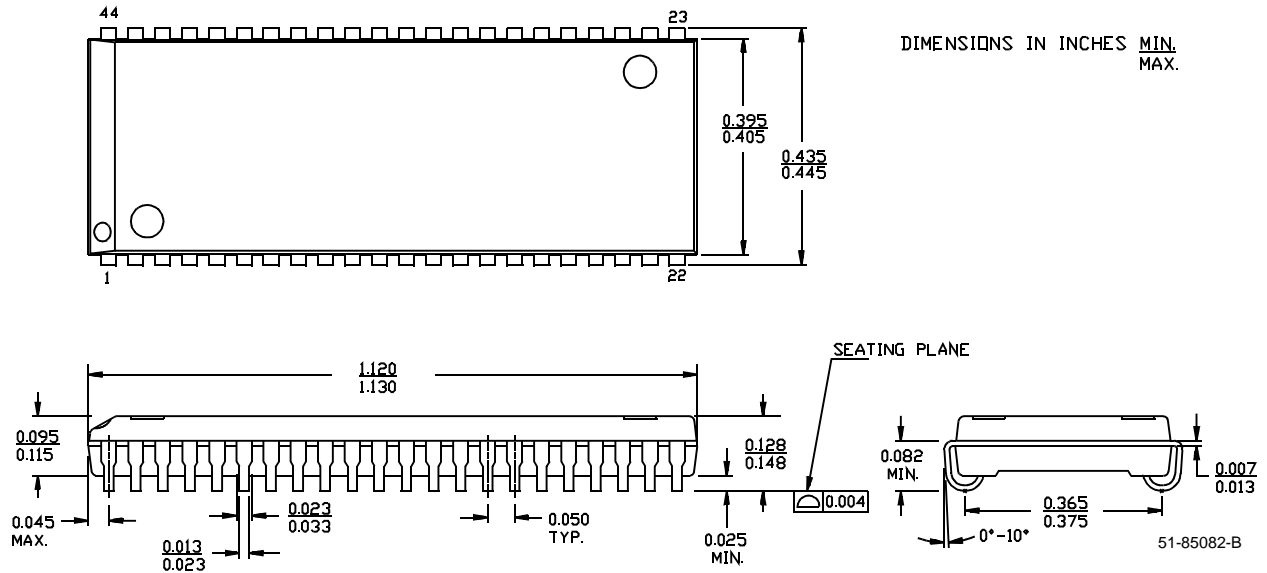
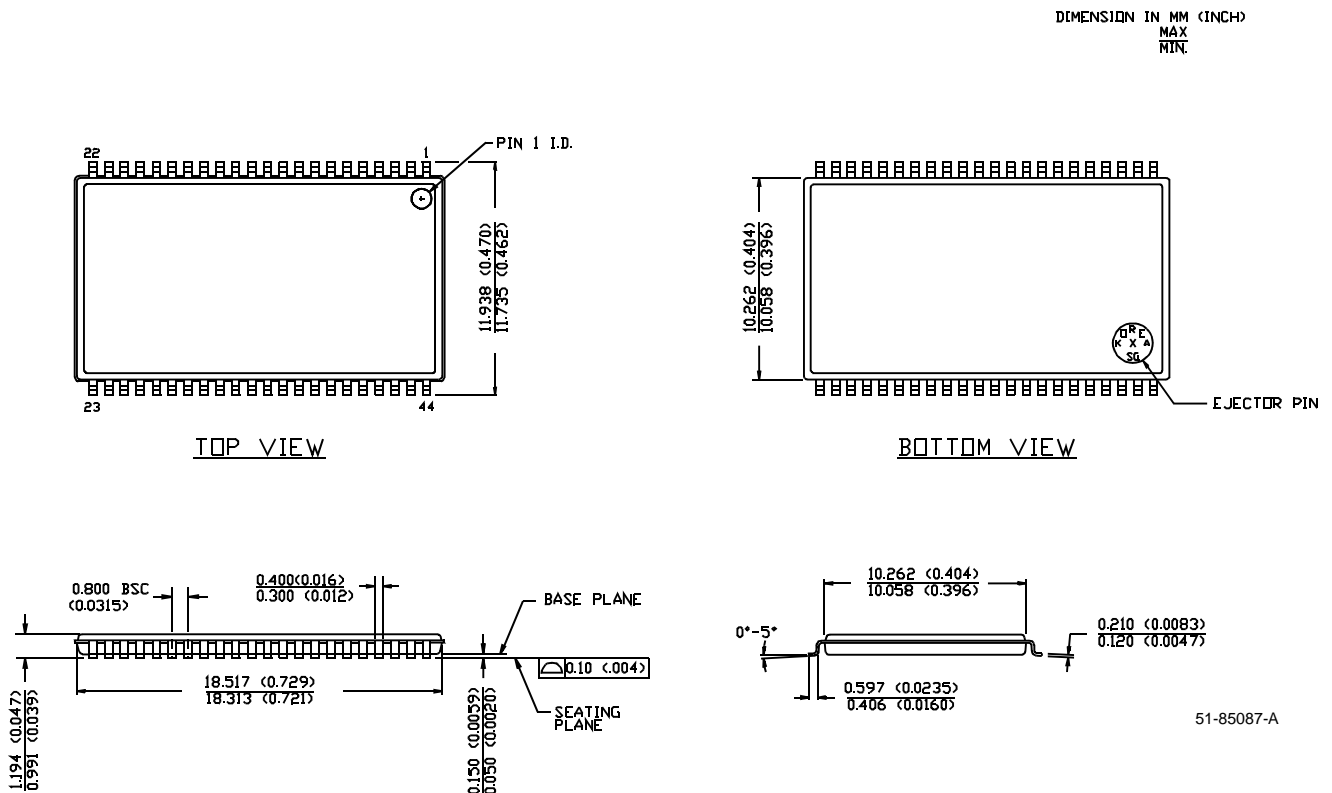
1021V-10

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	CY7C1021V33-10BAC	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	Commercial
	CY7C1021V33-10VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021V33L-10VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021V33-10ZC	Z44	44-Lead TSOP Type II	
	CY7C1021V33L-10ZC	Z44	44-Lead TSOP Type II	
12	CY7C1021V33-12BAC	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	Commercial
	CY7C1021V33-12VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021V33L-12VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021V33-12ZC	Z44	44-Lead TSOP Type II	
	CY7C1021V33L-12ZC	Z44	44-Lead TSOP Type II	
	CY7C1021V33-12BAI	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	Industrial
	CY7C1021V33-12VI	V34	44-Lead (400-Mil) Molded SOJ	
15	CY7C1021V33-15BAC	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	Commercial
	CY7C1021V33L-15BAC	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	
	CY7C1021V33-15VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021V33L-15VC	V34	44-Lead (400-Mil) Molded SOJ	
	CY7C1021V33-15ZC	Z44	44-Lead TSOP Type II	
	CY7C1021V33L-15VC	Z44	44-Lead TSOP Type II	Industrial
	CY7C1021V33-15BAI	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	
	CY7C1021V33L-15BAI	BA48	48-Ball Mini Ball Grid Array (7.00 mm x 7.00 mm)	
	CY7C1021V33-15VI	V34	44-Lead (400-Mil) Molded SOJ	
CY7C1021V33L-15ZI	Z44	44-Lead TSOP Type II		

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
**	107251	09/10/01	SZV	Change from Spec number: 38-00544 to 38-05060