1-Mbit (64K x 16) Static RAM

Features

- Temperature Ranges
  - — Industrial: –40°C to 85°C
  - — Automotive-A: –40°C to 85°C
  - — Automotive-E: –40°C to 125°C
- Pin-and function-compatible with CY7C1021CV33
- High speed
  - — t_{AA} = 10 ns
- Low active power
  - — I_{CC} = 60 mA @ 10 ns
- Low CMOS standby power
  - — I_{SB2} = 3 mA
- 2.0V data retention
- Automatic power-down when deselected
- CMOS for optimum speed/power
- Independent control of upper and lower bits
- Available in Pb-free 44-pin 400-Mil wide Molded SOJ, 44-pin TSOP II and 48-ball VFBGA packages

Functional Description[1]

The CY7C1021DV33 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_0 through I/O_7), 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_8 through I/O_{15}) 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_0 to I/O_7. If Byte High Enable ($\overline{BHE}$) is LOW, then data from memory will appear on I/O_8 to I/O_{15}. See the truth table at the end of this data sheet for a complete description of Read and Write modes.

The input/output pins (I/O_0 through I/O_{15}) are placed in a high-impedance state when the device is deselected ($\overline{CE}$ HIGH), the outputs are disabled ($\overline{OE}$ HIGH), the BHE and BLE are disabled ($\overline{BHE}$, $\overline{BLE}$ HIGH), or during a Write operation ($\overline{CE}$ LOW, and $\overline{WE}$ LOW).

The CY7C1021DV33 is available in Pb-free 44-pin 400-Mil wide Molded SOJ, 44-pin TSOP II and 48-ball VFBGA packages.

Logic Block Diagram
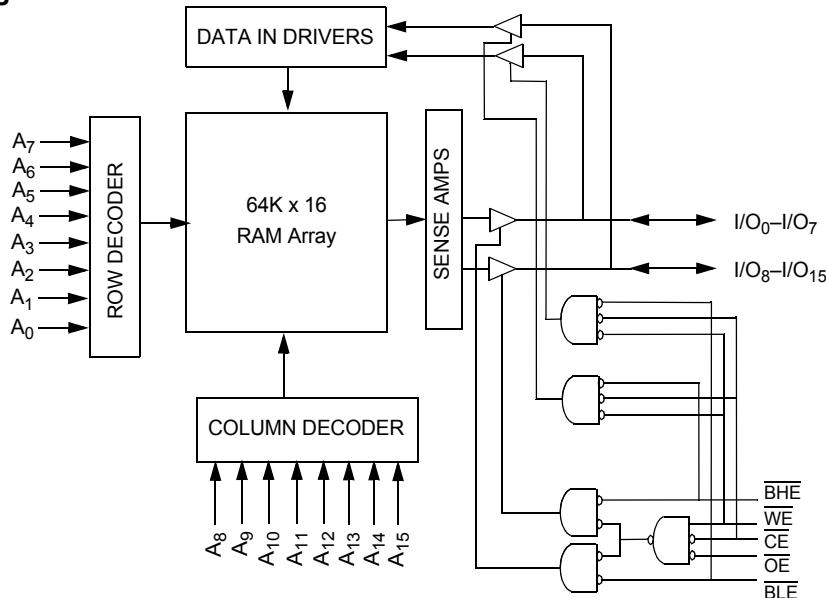
Note
1. For guidelines on SRAM system design, please refer to the "System Design Guidelines" Cypress application note, available on the internet at www.cypress.com

Selection Guide

	−10 (Industrial/Automotive-A)	−12 (Automotive-E)[2]	Unit
Maximum Access Time	10	12	ns
Maximum Operating Current	60	100	mA
Maximum CMOS Standby Current	3	15	mA

Pin Configuration[3]

SOJ/TSOP II
Top View

Left	Pin	Pin	Right
A_4	1	44	A_5
A_3	2	43	A_6
A_2	3	42	A_7
A_1	4	41	$\overline{OE}$
A_0	5	40	$\overline{BHE}$
$\overline{CE}$	6	39	$\overline{BLE}$
I/O_0	7	38	I/O_{15}
I/O_1	8	37	I/O_{14}
I/O_2	9	36	I/O_{13}
I/O_3	10	35	I/O_{12}
V_{CC}	11	34	V_{SS}
V_{SS}	12	33	V_{CC}
I/O_4	13	32	I/O_{11}
I/O_5	14	31	I/O_{10}
I/O_6	15	30	I/O_9
I/O_7	16	29	I/O_8
$\overline{WE}$	17	28	NC
A_{15}	18	27	A_8
A_{14}	19	26	A_9
A_{13}	20	25	A_{10}
A_{12}	21	24	A_{11}
NC	22	23	NC

48-ball VFBGA
Top View

	1	2	3	4	5	6	
A	$\overline{BLE}$	$\overline{OE}$	A_0	A_1	A_2	NC	A
B	I/O_8	$\overline{BHE}$	A_3	A_4	$\overline{CE}$	I/O_0	B
C	I/O_9	I/O_{10}	A_5	A_6	I/O_2	I/O_1	C
D	V_{SS}	I/O_{11}	NC	A_7	I/O_3	V_{CC}	D
E	V_{CC}	I/O_{12}	NC	NC	I/O_4	V_{SS}	E
F	I/O_{14}	I/O_{13}	A_{14}	A_{15}	I/O_5	I/O_6	F
G	I/O_{15}	NC	A_{12}	A_{13}	$\overline{WE}$	I/O_7	G
H	NC	A_8	A_9	A_{10}	A_{11}	NC	H

Notes
2. Automotive product information is Preliminary.
3. NC pins are not connected on the die.

[+] Feedback

Maximum Ratings

(Above which the useful life may be impaired. For user guide-lines, 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[4] .... −0.3V to +4.6V

DC Voltage Applied to Outputs
in High-Z State[4] .... −0.3V to V_{CC}+0.3V

DC Input Voltage[4] .... −0.3V to V_{CC}+0.3V

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}	Speed
Industrial	−40 C to +85 C	3.3V ± 0.3V	10 ns
Automotive-A	−40 C to +85 C		10 ns
Automotive-E	−40 C to +125 C		12 ns

DC Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions		−10 (Ind'l/Auto-A) Min.	−10 (Ind'l/Auto-A) Max.	−12 (Auto-E) Min.	−12 (Auto-E) Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = −4.0 mA		2.4		2.4		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL} = 8.0 mA			0.4		0.4	V
V_{IH}	Input HIGH Voltage			2.0	V_{CC} + 0.3	2.0	V_{CC} + 0.3	V
V_{IL}	Input LOW Voltage[4]			−0.3	0.8	−0.3	0.8	V
I_{IX}	Input Leakage Current	GND ≤ V_I ≤ V_{CC}		−1	+1	−5	+5	μA
I_{OZ}	Output Leakage Current	GND ≤ V_I ≤ V_{CC}, Output Disabled		−1	+1	−5	+5	μA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., I_{OUT} = 0 mA, f = f_{MAX} = 1/t_{RC}	100 MHz		60		-	mA
			83 MHz		55		100	mA
			66 MHz		45		90	mA
			40 MHz		30		60	mA
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}			10		50	mA
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		15	mA

Capacitance[5]

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[5]

Parameter	Description	Test Conditions	SOJ	TSOP II	VFBGA	Unit
Θ_{JA}	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 3 × 4.5 inch, four-layer printed circuit board	59.52	53.91	36	°C/W
Θ_{JC}	Thermal Resistance (Junction to Case)		36.75	21.24	9	°C/W

Notes
4. V_{IL} (min.) = −2.0V and V_{IH}(max) = V_{CC} + 1V for pulse durations of less than 5 ns.
5. Tested initially and after any design or process changes that may affect these parameters.

[+] Feedback

AC Test Loads and Waveforms[6]

Z = 50Ω

OUTPUT

50Ω

30 pF*

1.5V

* CAPACITIVE LOAD CONSISTS
OF ALL COMPONENTS OF THE
TEST ENVIRONMENT

(a)

3.0V

ALL INPUT PULSES

90%

90%

GND

10%

10%

Rise Time: 1 V/ns

Fall Time: 1 V/ns

(b)

High-Z characteristics: R 317Ω

3.3V

OUTPUT

5 pF

R2
351Ω

(c)
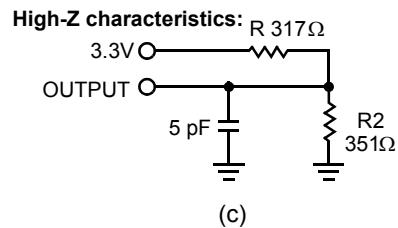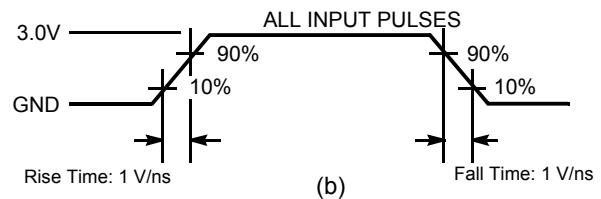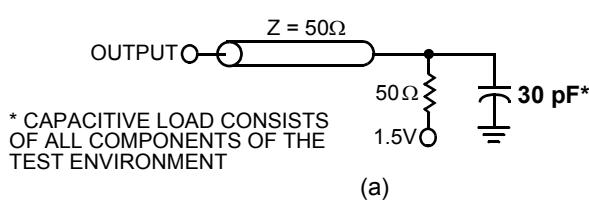
Note
6. AC characteristics (except High-Z) are tested using the load conditions shown in Figure (a). High-Z characteristics are tested for all speeds using the test load
shown in Figure (c).

Switching Characteristics Over the Operating Range[7]

| Parameter	Description	-10 (Ind'l/Auto-A) Min.	-10 (Ind'l/Auto-A) Max.	-12 (Auto-E) Min.	-12 (Auto-E) Max.	Unit
Read Cycle						
t_{power}[8]	V_{CC}(typical) to the first access	100		100		µs
t_{RC}	Read Cycle Time	10		12		ns
t_{AA}	Address to Data Valid		10		12	ns
t_{OHA}	Data Hold from Address Change	3		3		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		10		12	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		5		6	ns
t_{LZOE}	$\overline{OE}$ LOW to Low-Z[10]	0		0		ns
t_{HZOE}	$\overline{OE}$ HIGH to High-Z[9, 10]		5		6	ns
t_{LZCE}	$\overline{CE}$ LOW to Low-Z[10]	3		3		ns
t_{HZCE}	$\overline{CE}$ HIGH to High-Z[9, 10]		5		6	ns
t_{PU}[11]	$\overline{CE}$ LOW to Power-Up	0		0		ns
t_{PD}[11]	$\overline{CE}$ HIGH to Power-Down		10		12	ns
t_{DBE}	Byte Enable to Data Valid		5		6	ns
t_{LZBE}	Byte Enable to Low-Z	0		0		ns
t_{HZBE}	Byte Disable to High-Z		6		6	ns
Write Cycle[12]						
t_{WC}	Write Cycle Time	10		12		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	8		9		ns
t_{AW}	Address Set-Up to Write End	8		9		ns
t_{HA}	Address Hold from Write End	0		0		ns
t_{SA}	Address Set-Up to Write Start	0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	7		8		ns
t_{SD}	Data Set-Up to Write End	5		6		ns
t_{HD}	Data Hold from Write End	0		0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z[10]	3		3		ns
t_{HZWE}	$\overline{WE}$ LOW to High-Z[9, 10]		5		6	ns
t_{BW}	Byte Enable to End of Write	7		8		ns

Notes
7. 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.
8. t_{POWER} gives the minimum amount of time that the power supply should be at typical V_{CC} values until the first memory access can be performed.
9. t_{HZOE}, t_{HZBE}, t_{HZCE}, and t_{HZWE} are specified with a load capacitance of 5 pF as in (c) of AC Test Loads. Transition is measured when the outputs enter a high impedance state
10. 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.
11. This parameter is guaranteed by design and is not tested.
12. 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.

## Data Retention Characteristics Over the Operating Range

Parameter	Description	Conditions		Min.	Max.	Unit
V_{DR}	V_{CC} for Data Retention			2		V
I_{CCDR}	Data Retention Current	$V_{CC} = V_{DR} = 2.0V, \overline{CE} \geq V_{CC} - 0.3V,$ $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$	Industrial		3	mA
			Automotive		15	mA
t_{CDR}[5]	Chip Deselect to Data Retention Time			0		ns
t_R[13]	Operation Recovery Time			t_{RC}		ns

Data Retention Waveform
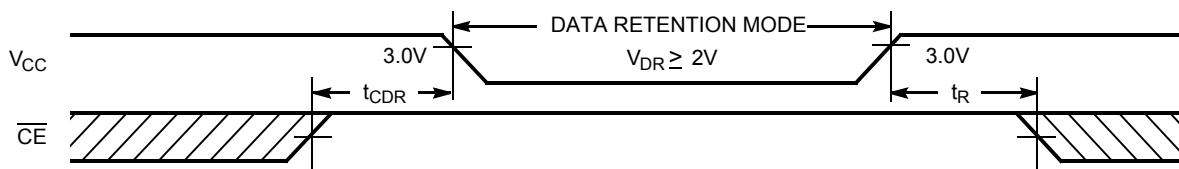
Switching Waveforms

Read Cycle No. 1 (Address Transition Controlled)[14, 15]
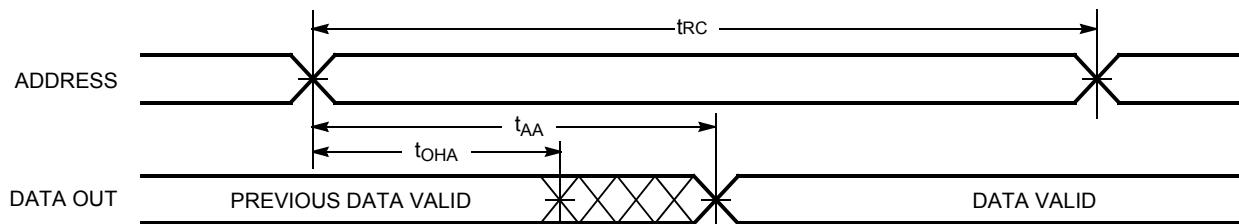
### Read Cycle No. 2 ($\overline{OE}$ Controlled)[15, 16]
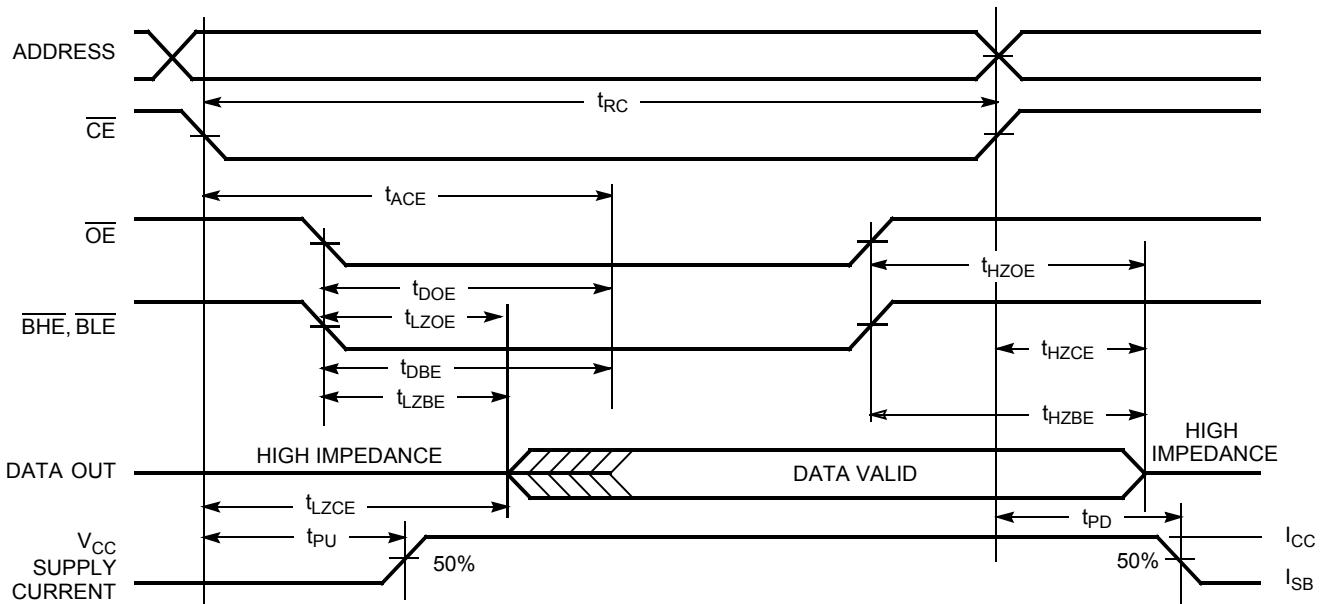

Notes
13. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} \geq 50 \mu s$ or stable at $V_{CC(min.)} \geq 50 \mu s$.
14. Device is continuously selected. OE, CE, BHE and/or BLE = V_{IL}.
15. $\overline{WE}$ is HIGH for Read cycle.
16. Address valid prior to or coincident with $\overline{CE}$ transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 ($\overline{\text{CE}}$ Controlled)[17, 18]
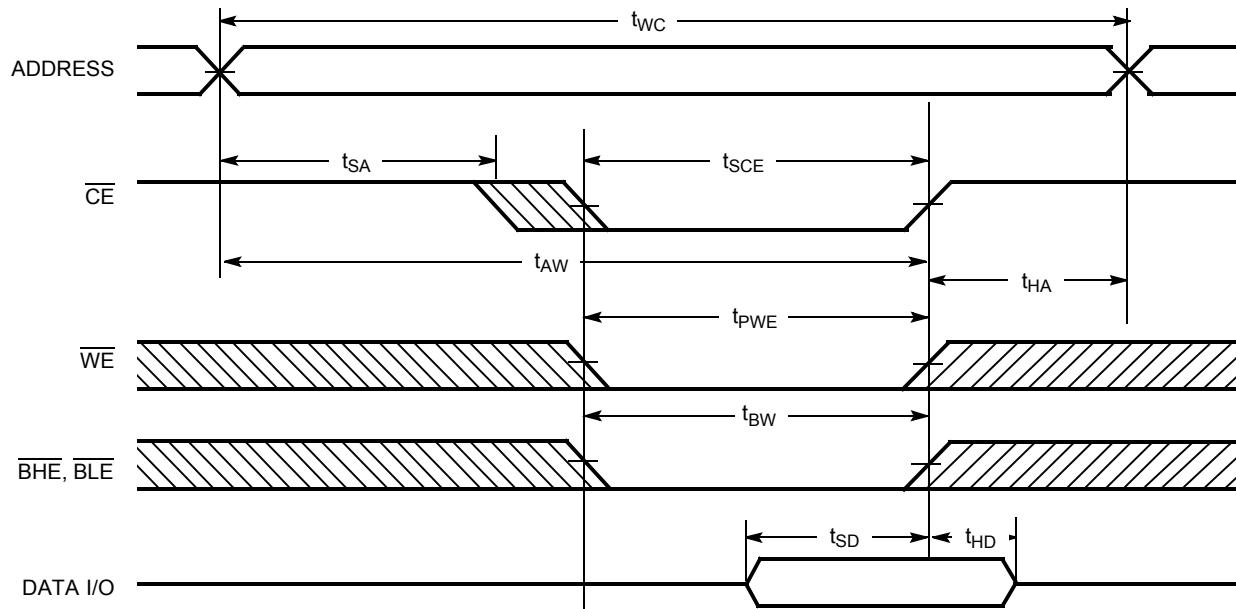
Write Cycle No. 2 ($\overline{\text{BLE}}$ or $\overline{\text{BHE}}$ Controlled)
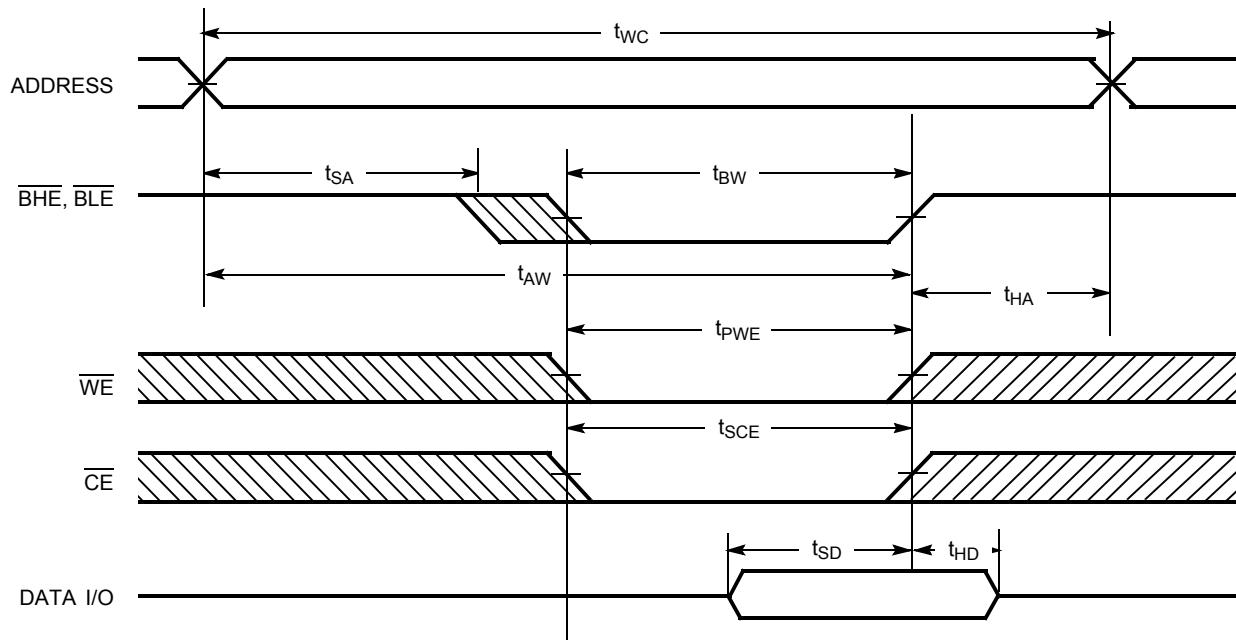
**Notes**
17. Data I/O is high impedance if $\overline{\text{OE}}$ or $\overline{\text{BHE}}$ and/or $\overline{\text{BLE}}$ = V_{IH}.
18. If $\overline{\text{CE}}$ goes HIGH simultaneously with $\overline{\text{WE}}$ going HIGH, the output remains in a high-impedance state.

Document #: 38-05460 Rev. *F

[+] Feedback

Switching Waveforms (continued)

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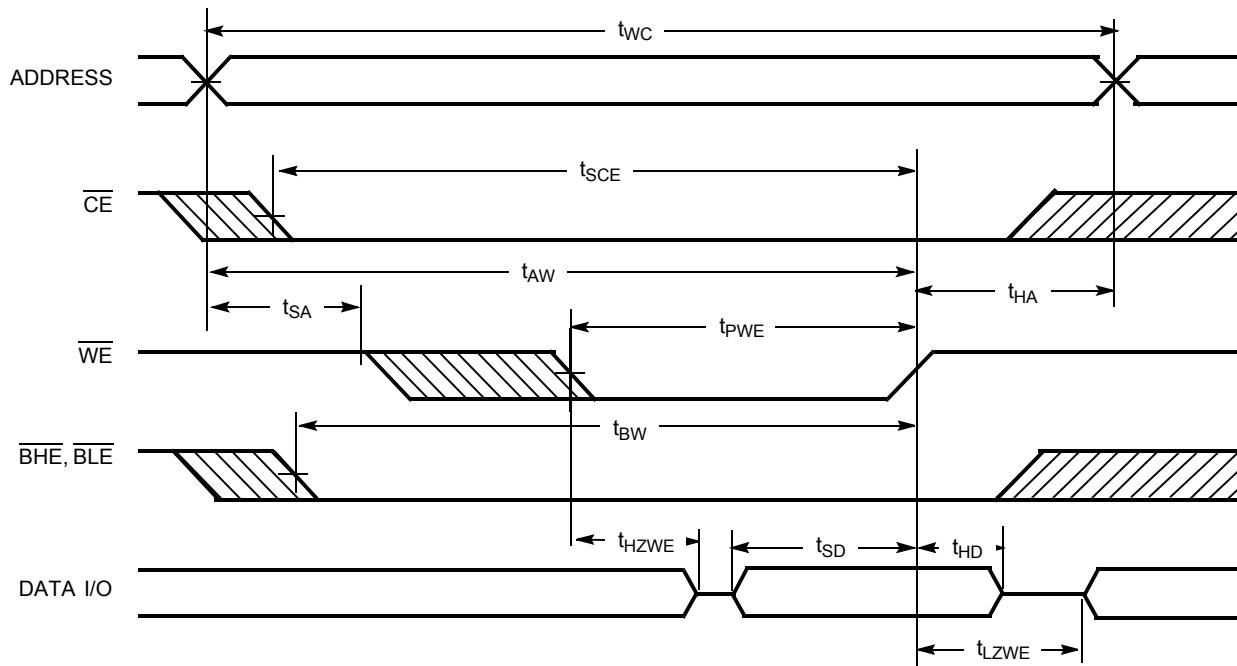
Truth Table

$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	I/O_0–I/O_7	I/O_8–I/O_{15}	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})

[+] Feedback

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
10	CY7C1021DV33-10VXI	51-85082	44-pin (400-Mil) Molded SOJ (Pb-free)	Industrial
	CY7C1021DV33-10ZSXI	51-85087	44-pin TSOP Type II (Pb-free)	
	CY7C1021DV33-10BVXI	51-85150	48-ball VFBGA (Pb-free)	
10	CY7C1021DV33-10ZSXA	51-85087	44-pin TSOP Type II (Pb-free)	Automotive-A
12	CY7C1021DV33-12ZSXE	51-85087	44-pin TSOP Type II (Pb-free)	Automotive-E

Ordering Code Definitions

CY 7 C 1 02 1 D V33 - XX XXX X

Temperature Range: X = I or A or E
I = Industrial; A = Automotive-A; E = Automotive-E
Package Type: XXX = VX or ZSX or BVX
VX = 44-pin Molded SOJ (Pb-free)
ZSX = 44-pin TSOP Type II (Pb-free)
BVX = 48-ball VFBGA (Pb-free)
Speed: XX = 10 ns or 12 ns
V33 = Voltage range (3 V to 3.6 V)
D = C9, 90 nm Technology
1 = Data width × 16-bits
02 = 1-Mbit density
1 = Fast Asynchronous SRAM family
Technology Code: C = CMOS
7 = SRAM
CY = Cypress

Please contact your local Cypress sales representative for availability of these parts.

[+] Feedback

Package Diagrams

Figure 1. 44-pin (400-Mil) Molded SOJ (51-85082)
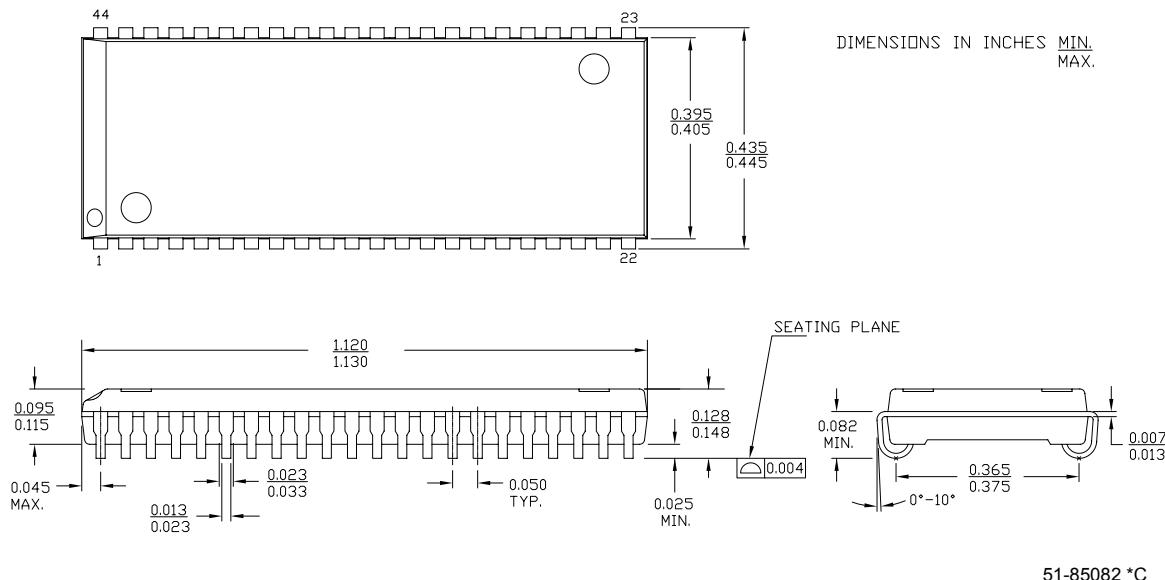
51-85082 *C

Figure 2. 44-pin Thin Small Outline Package Type II (51-85087)

51-85087 *C

[+] Feedback
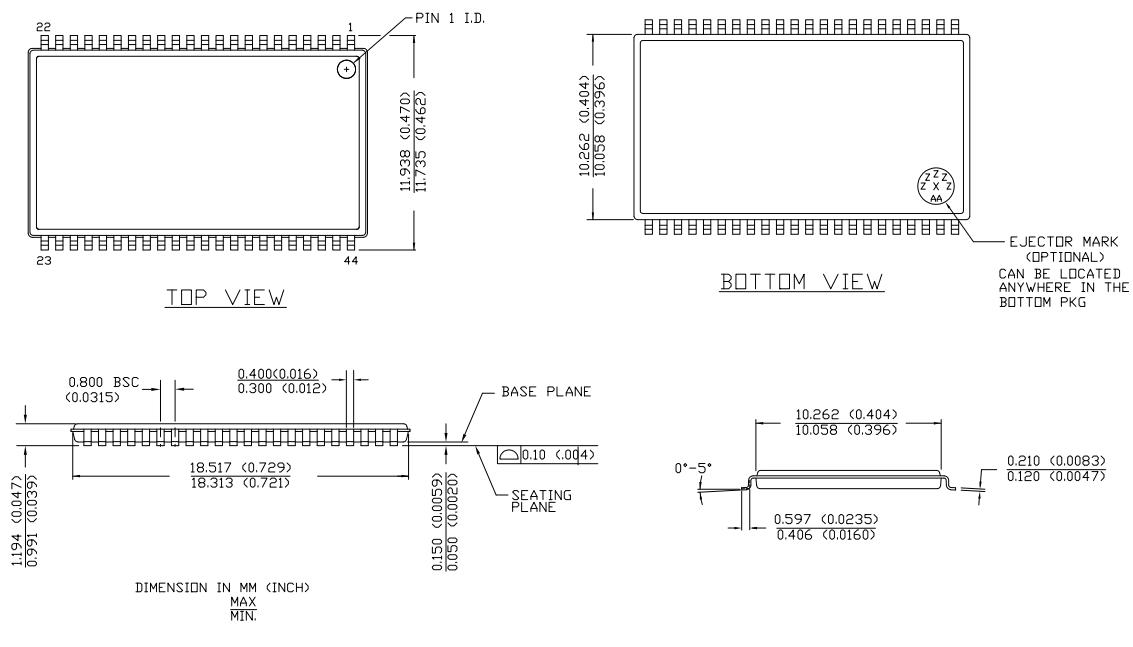
Package Diagrams (continued)

Figure 3. 48-ball VFBGA (6 x 8 x 1 mm) (51-85150)
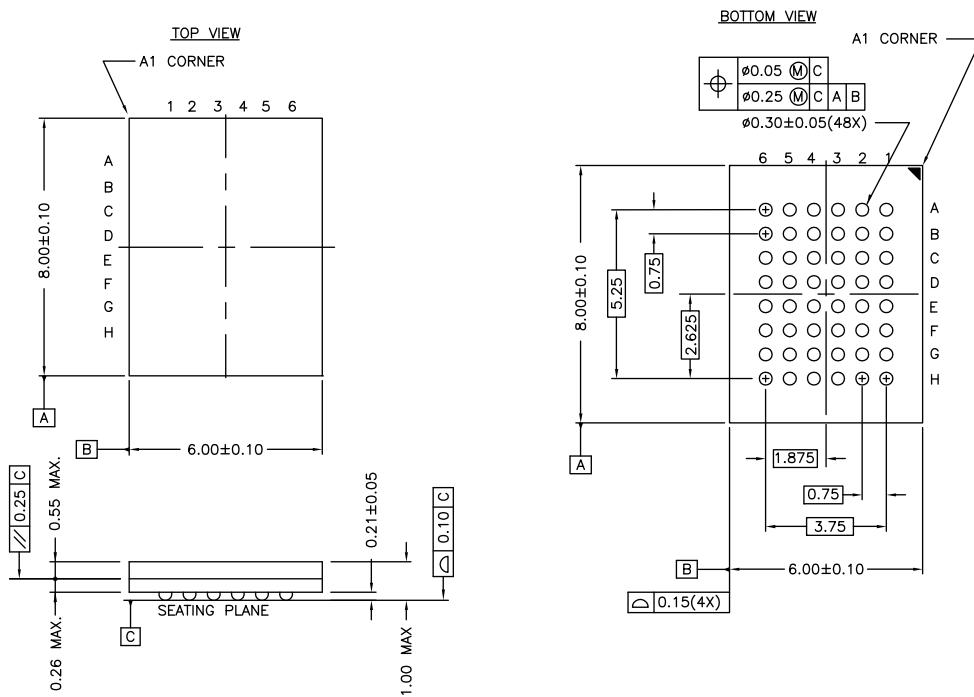
51-85150 *F

All products and company names mentioned in this document are the trademarks of their respective holders.

Document History Page

Document Title: CY7C1021DV33, 1-Mbit (64K x 16) Static RAM

| Document Number: 38-05460 |

REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	201560	See ECN	SWI	Advance Information data sheet for C9 IPP
*A	233693	See ECN	RKF	DC parameters are modified as per Eros (Spec # 01-02165). Pb-free Offering In Ordering Information
*B	263769	See ECN	RKF	Changed $I/O_1 – I/O_{16}$ to $I/O_0 – I/O_{15}$ Added Data Retention Characteristics table Added T_{power} Spec in Switching Characteristics table Shaded Ordering Information
*C	307601	See ECN	RKF	Reduced Speed bins to –8 and –10 ns
*D	520652	See ECN	VKN	Converted from Preliminary to Final Removed Commercial Operating range Removed 8 ns speed bin Added I_{CC} values for the frequencies 83MHz, 66MHz and 40MHz Added Automotive Information Updated Thermal Resistance table Updated Ordering Information Table Changed Overshoot spec from V_{CC}+2V to V_{CC}+1V in footnote #4
*E	2898399	03/24/2010	AJU	Updated Package Diagrams
*F	3109897	12/14/2010	AJU	Added Ordering Code Definitions. Updated Package Diagrams.

[+] Feedback

Sales, Solutions, and Legal Information

Worldwide Sales and Design Support

Cypress maintains a worldwide network of offices, solution centers, manufacturer's representatives, and distributors. To find the office closest to you, visit us at cypress.com/sales.

Products

Automotive	cypress.com/go/automotive	**PSoC Solutions**
Clocks & Buffers	cypress.com/go/clocks	psoc.cypress.com/solutions
Interface	cypress.com/go/interface	PSoC 1	PSoC 3	PSoC 5
Lighting & Power Control	cypress.com/go/powerpsoc	
	cypress.com/go/plc	
Memory	cypress.com/go/memory	
Optical & Image Sensing	cypress.com/go/image	
PSoC	cypress.com/go/psoc	
Touch Sensing	cypress.com/go/touch	
USB Controllers	cypress.com/go/USB	
Wireless/RF	cypress.com/go/wireless	

[+] Feedback