CY7C1041CV33

4-Mbit (256K x 16) Static RAM

Features

- **Pin equivalent to CY7C1041BV33**
- **Temperature Ranges**
  - **— Commercial: 0°C to 70°C**
  - **— Industrial: –40°C to 85°C**
  - **— Automotive-A: –40°C to 85°C**
  - **— Automotive-E: –40°C to 125°C**
- **High speed**
  - **— t_{AA} = 10 ns**
- **Low active power**
  - **— 324 mW (max.)**
- **2.0V data retention**
- **Automatic power-down when deselected**
- **TTL-compatible inputs and outputs**
- **Easy memory expansion with $\overline{CE}$ and $\overline{OE}$ features**
- **Available in Pb-free and non Pb-free 44-pin 400-mil-SOJ, 44-pin TSOP II and 48-ball FBGA packages**

Functional Description[1]

The CY7C1041CV33 is a high-performance CMOS Static RAM organized as 262,144 words by 16 bits.

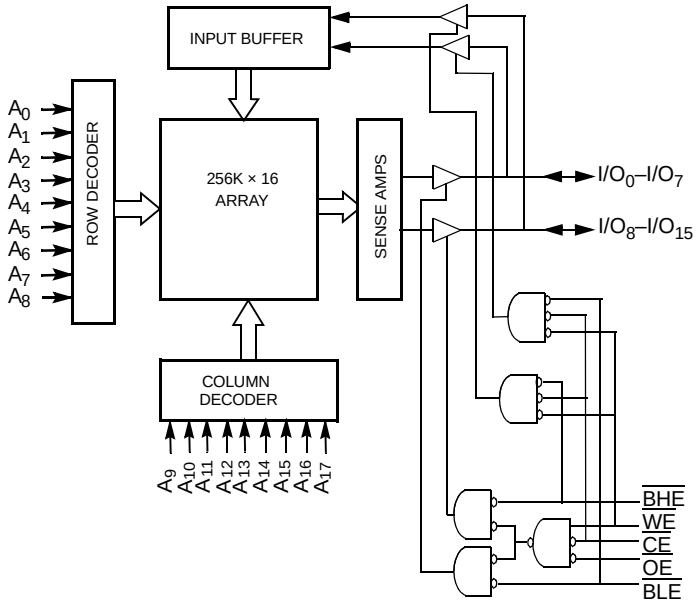
Writing to the device is accomplished by taking Chip Enable ($\overline{CE}$) and Write Enable ($\overline{WE}$) inputs LOW. If Byte LOW Enable ($\overline{BLE}$) is LOW, then data from I/O pins (I/O_0–I/O_7), is written into the location specified on the address pins (A_0–A_{17}). If Byte HIGH Enable ($\overline{BHE}$) is LOW, then data from I/O pins (I/O_8–I/O_{15}) is written into the location specified on the address pins (A_0–A_{17}).

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 – 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 back of this data sheet for a complete description of Read and Write modes.

The input/output pins (I/O_0–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 $\overline{BHE}$ and $\overline{BLE}$ are disabled ($\overline{BHE}$, $\overline{BLE}$ HIGH), or during a Write operation ($\overline{CE}$ LOW, and $\overline{WE}$ LOW).

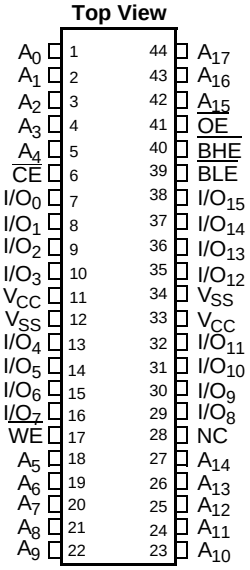
The CY7C1041CV33 is available in a standard 44-pin 400-mil-wide body width SOJ and 44-pin TSOP II package with center power and ground (revolutionary) pinout, as well as a 48-ball fine-pitch ball grid array (FBGA) package.

Logic Block Diagram



Pin Configuration

SOJ/
TSOP II
Top View



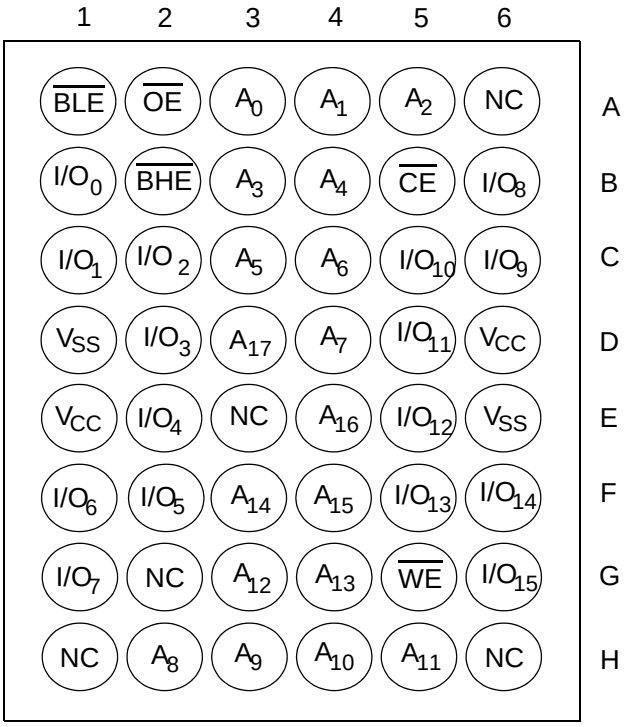
Notes:
1. For guidelines on SRAM system design, please refer to the “System Design Guidelines” Cypress application note, available on the internet at www.cypress.com.

Selection Guide

		-10	-12	-15	-20	Unit
Maximum Access Time		10	12	15	20	ns
Maximum Operating Current	Commercial	90	85	80	75	mA
	Industrial	100	95	90	85	mA
	Automotive-A	100			85	mA
	Automotive-E				90	mA
Maximum CMOS Standby Current	Commercial/ Industrial	10	10	10	10	mA
	Automotive-A	10				mA
	Automotive-E				15	mA

Pin Configurations

48-ball FBGA
(Top View)



Pin Definitions

Pin Name	44-SOJ, 44-TSOP Pin Number	48-ball FBGA Pin Number	I/O Type	Description
A_0–A_{17}	1–5, 18–27, 42–44	A3, A4, A5, B3, B4, C3, C4, D4, H2, H3, H4, H5, G3, G4, F3, F4, E4, D3	Input	**Address Inputs used to select one of the address locations.**
I/O_0–I/O_{15}	7–10,13–16, 29–32, 35–38	B1, C1, C2, D2, E2, F2, F1, G1, B6, C6, C5, D5, E5, F5, F6, G6	Input/Output	**Bidirectional Data I/O lines.** Used as input or output lines depending on operation
NC	28	A6, E3, G2, H1, H6	No Connect	**No Connects.** This pin is not connected to the die
$\overline{WE}$	17	G5	Input/Control	**Write Enable Input, active LOW.** When selected LOW, a WRITE is conducted. When selected HIGH, a READ is conducted.
$\overline{CE}$	6	B5	Input/Control	**Chip Enable Input, active LOW.** When LOW, selects the chip. When HIGH, deselects the chip.
$\overline{BHE}$, $\overline{BLE}$	40, 39	B2, A1	Input/Control	**Byte Write Select Inputs, active LOW.** $\overline{BHE}$ controls I/O_{15}–I/O_8, $\overline{BLE}$ controls I/O_7–I/O_0
$\overline{OE}$	41	A2	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 tri-stated, and act as input data pins.
V_{SS}	12, 34	D1, E6	Ground	**Ground for the device.** Should be connected to ground of the system.
V_{CC}	11, 33	D6, E1	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[2] .... –0.5V to +4.6V

DC Voltage Applied to Outputs in High-Z State[2] .....–0.5V to V_{CC} + 0.5V

DC Input Voltage[2].....–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 ± 0.3V
Industrial	–40°C to +85°C	
Automotive-A	–40°C to +85°C	
Automotive-E	–40°C to +125°C	

DC Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions		-10		-12		-15		-20		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			2.0	V_{CC} + 0.3	2.0	V_{CC} + 0.3	2.0	V_{CC} + 0.3	2.0	V_{CC} + 0.3	V
V_{IL}[2]	Input LOW Voltage			–0.3	0.8	–0.3	0.8	–0.3	0.8	–0.3	0.8	V
I_{IX}	Input Leakage Current	GND ≤ V_I ≤ V_{CC}	Com'l/Ind'l	–1	+1	–1	+1	–1	+1	–1	+1	µA
			Auto-A	–1	+1					–1	+1	µA
			Auto-E							–20	+20	µA
I_{OZ}	Output Leakage Current	GND ≤ V_{OUT} ≤ V_{CC}, Output Disabled	Com'l/Ind'l	–1	+1	–1	+1	–1	+1	–1	+1	µA
			Auto-A	–1	+1					–1	+1	µA
			Auto-E							–20	+20	µA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., f = f_{MAX} = $1/t_{RC}$	Com'l		90		85		80		75	mA
			Ind'l		100		95		90		85	mA
			Auto-A		100						85	mA
			Auto-E								90	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}	Com'l/Ind'l		40		40		40		40	mA
			Auto-A		40						40	mA
			Auto-E								45	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	Com'l/Ind'l		10		10		10		10	mA
			Auto-A		10						10	mA
			Auto-E								15	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}	I/O Capacitance		8	pF

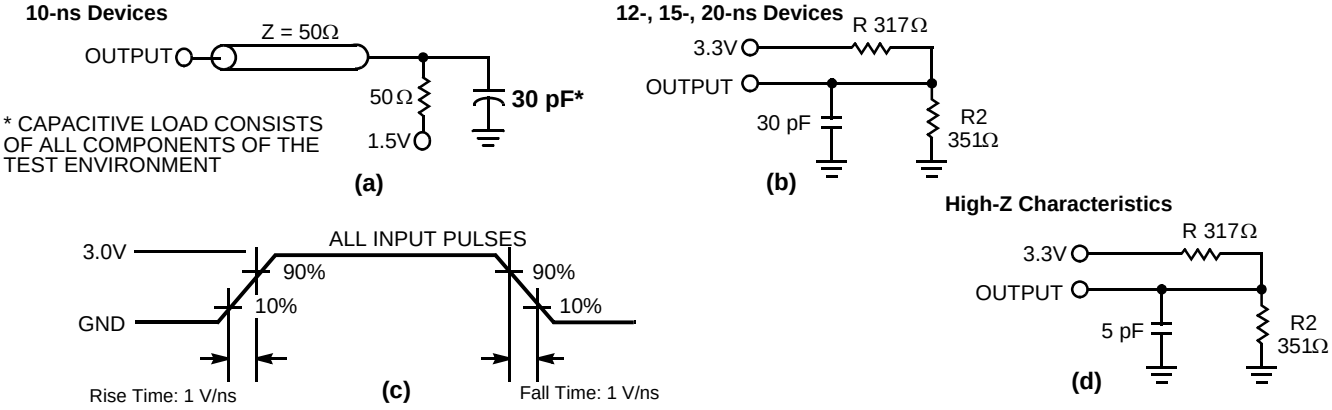
Notes:

2. V_{IL} (min.) = –2.0V and V_{IH}(max) = V_{CC} + 0.5V for pulse durations of less than 20 ns.
3. Tested initially and after any design or process changes that may affect these parameters.

Thermal Resistance[3]

Parameter	Description	Test Conditions	TSOP-II	FBGA	SOJ	Unit
Θ_{JA}	Thermal Resistance (Junction to Ambient)	Test conditions follow standard test methods and procedures for measuring thermal impedance, per EIA / JESD51.	42.96	38.15	25.99	°C/W
Θ_{JC}	Thermal Resistance (Junction to Case)		10.75	9.15	18.8	°C/W

AC Test Loads and Waveforms[4]



AC Switching Characteristics[5] Over the Operating Range

Parameter	Description	-10		-12		-15		-20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle										
t_{power}[6]	V_{CC}(typical) to the first access	100		100		100		100		µs
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		6		7		8	ns
t_{LZOE}	$\overline{OE}$ LOW to Low-Z	0		0		0		0		ns
t_{HZOE}	$\overline{OE}$ HIGH to High-Z[7, 8]		5		6		7		8	ns
t_{LZCE}	$\overline{CE}$ LOW to Low-Z[8]	3		3		3		3		ns
t_{HZCE}	$\overline{CE}$ HIGH to High-Z[7, 8]		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		10		12		15		20	ns
t_{DBE}	Byte Enable to Data Valid		5		6		7		8	ns
t_{LZBE}	Byte Enable to Low-Z	0		0		0		0		ns
t_{HZBE}	Byte Disable to High-Z		6		6		7		8	ns

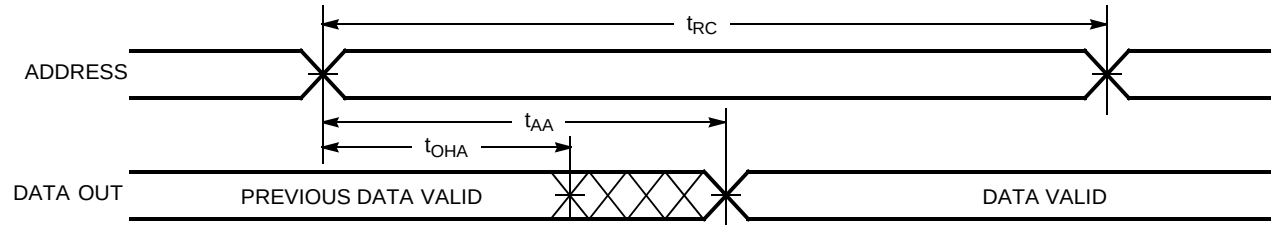
Notes:
4. AC characteristics (except High-Z) for 10-ns parts are tested using the load conditions shown in Figure (a). All other speeds are tested using the Thevenin load shown in Figure (b). High-Z characteristics are tested for all speeds using the test load shown in Figure (d).
5. Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V.
6. 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.
7. t_{HZOE}, t_{HZCE}, and t_{HZWE} are specified with a load capacitance of 5 pF as in part (d) of AC Test Loads. Transition is measured ±500 mV from steady-state voltage
8. 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.
9. The internal Write time of the memory is defined by the overlap of $\overline{CE}$ LOW, and $\overline{WE}$ LOW. $\overline{CE}$ and $\overline{WE}$ must be LOW to initiate a Write, and the transition of either 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.

AC Switching Characteristics[5] Over the Operating Range (continued)

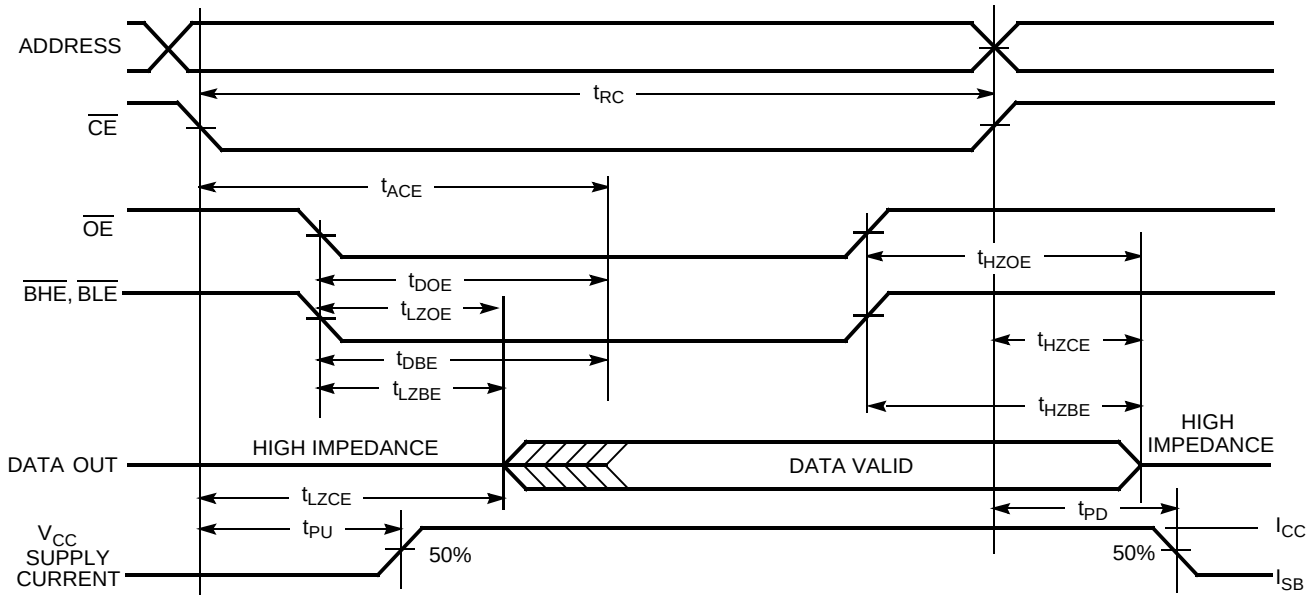
Parameter	Description	-10		-12		-15		-20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Write Cycle[9, 10]										
t_{WC}	Write Cycle Time	10		12		15		20		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	7		8		10		10		ns
t_{AW}	Address Set-Up to Write End	7		8		10		10		ns
t_{HA}	Address Hold from Write 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	7		8		10		10		ns
t_{SD}	Data Set-Up to Write End	5		6		7		8		ns
t_{HD}	Data Hold from Write End	0		0		0		0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z[7]	3		3		3		3		ns
t_{HZWE}	$\overline{WE}$ LOW to High-Z[7, 8]		5		6		7		8	ns
t_{BW}	Byte Enable to End of Write	7		8		10		10		ns

Switching Waveforms

Read Cycle No. 1[11, 12]



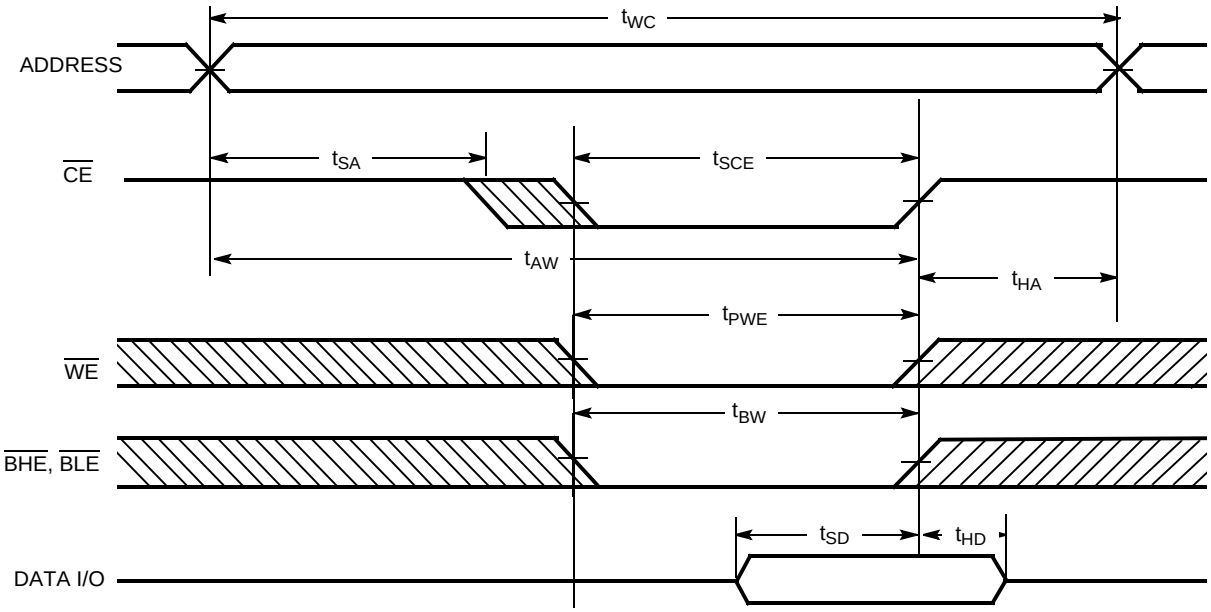
Read Cycle No. 2 ($\overline{OE}$ Controlled)[12, 13]



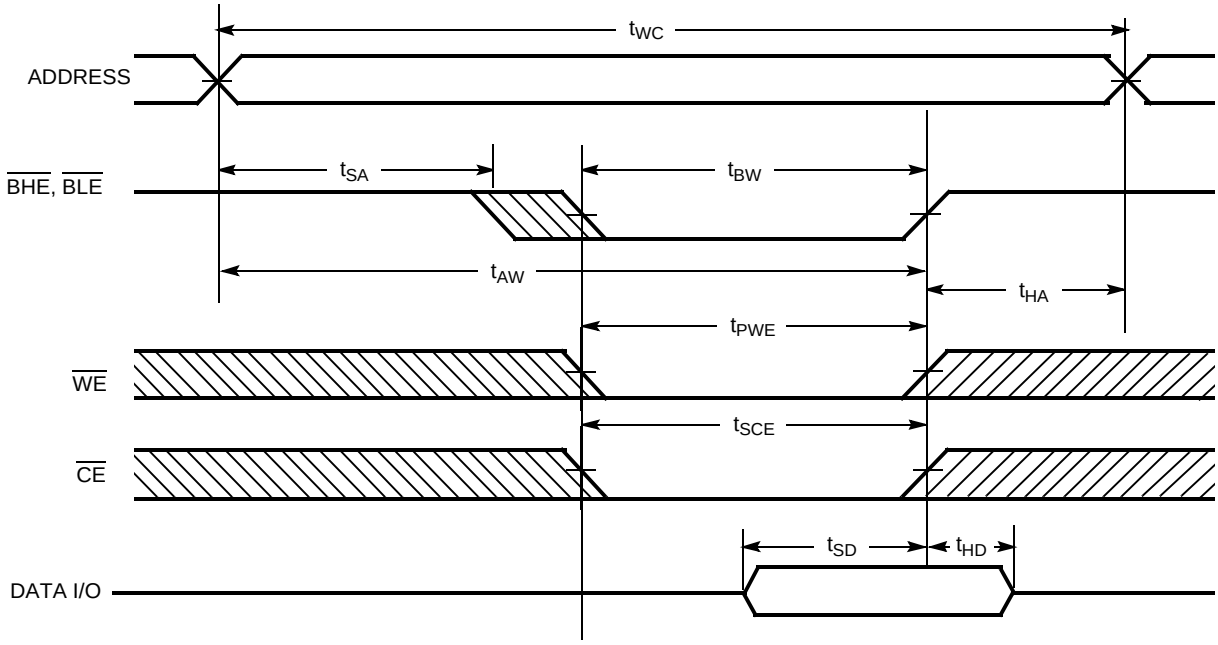
Notes:
10. The minimum Write cycle time for Write Cycle No. 3 ($\overline{WE}$ controlled, $\overline{OE}$ LOW) is the sum of t_{HZWE} and t_{SD}.
11. Device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{BHE}$ and/or $\overline{BHE}$ = V_{IL}.
12. $\overline{WE}$ is HIGH for Read cycle.
13. Address valid prior to or coincident with $\overline{CE}$ transition LOW.

Switching Waveforms (continued)

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



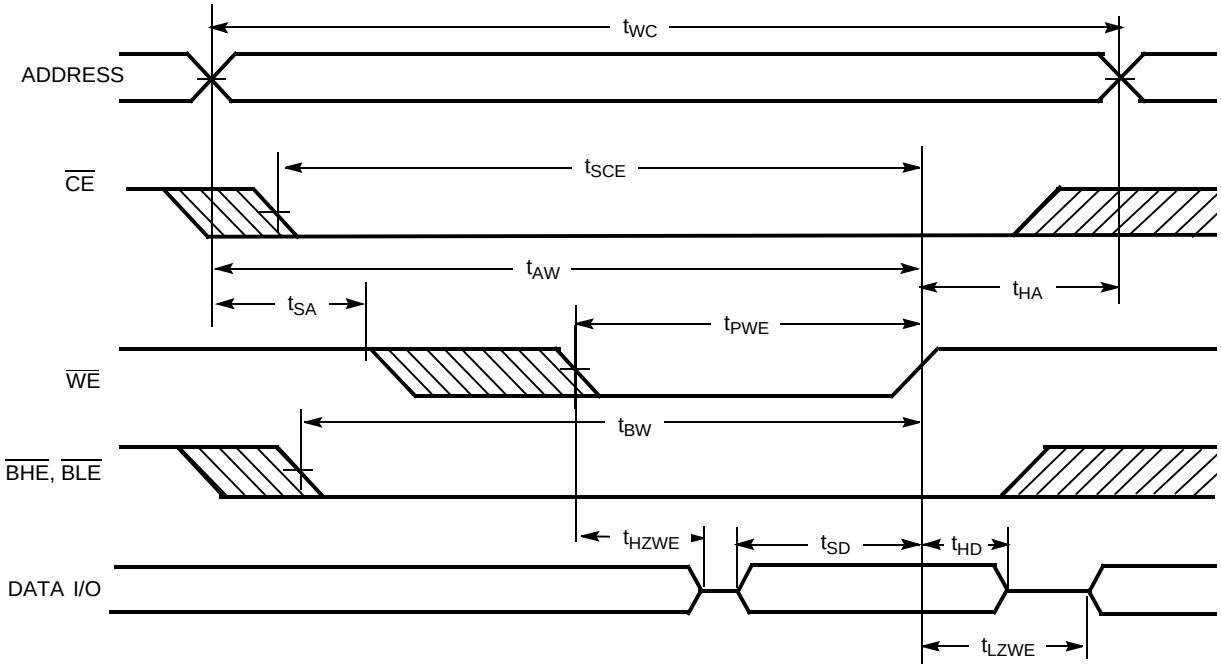
Write Cycle No. 2 ($\overline{BLE}$ or $\overline{BHE}$ Controlled)



Notes:
14. Data I/O is high-impedance if $\overline{OE}$ or $\overline{BHE}$ and/or $\overline{BLE}$ = V_{IH}.
15. 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. 2 ($\overline{WE}$ 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	L	H	L	H	Data Out	High-Z	Read Lower Bits Only	Active (I_{CC})
L	L	H	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	X	L	L	H	Data In	High-Z	Write Lower Bits Only	Active (I_{CC})
L	X	L	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})

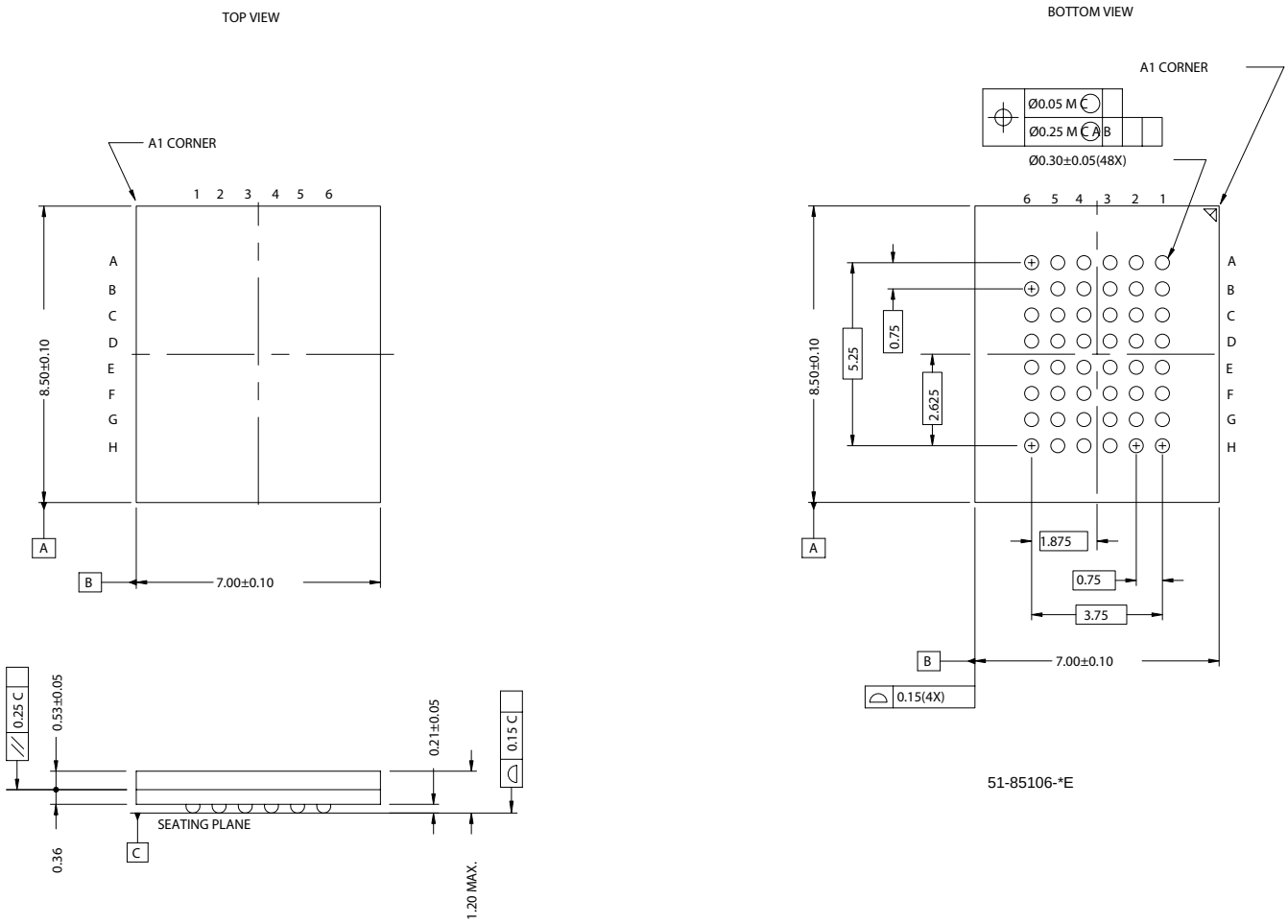
Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
10	CY7C1041CV33-10BAC	51-85106	48-ball Fine Pitch BGA	Commercial
	CY7C1041CV33-10BAXC		48-ball Fine Pitch BGA (Pb-Free)	
	CY7C1041CV33-10VC	51-85082	44-lead (400-mil) Molded SOJ	
	CY7C1041CV33-10VXC		44-lead (400-mil) Molded SOJ (Pb-Free)	
	CY7C1041CV33-10ZC	51-85087	44-pin TSOP II	
	CY7C1041CV33-10ZXC		44-pin TSOP II (Pb-Free)	
	CY7C1041CV33-10BAI	51-85106	48-ball Fine Pitch BGA	Industrial
	CY7C1041CV33-10BAXI		48-ball Fine Pitch BGA (Pb-Free)	
	CY7C1041CV33-10ZI	51-85087	44-pin TSOP II	
	CY7C1041CV33-10ZXI		44-pin TSOP II (Pb-Free)	
	CY7C1041CV33-10ZSXA		44-pin TSOP II (Pb-Free)	Automotive-A
	CY7C1041CV33-10BAXA	51-85106	48-ball Fine Pitch BGA (Pb-Free)	
12	CY7C1041CV33-12VC	51-85082	44-lead (400-mil) Molded SOJ	Commercial
	CY7C1041CV33-12VXC		44-lead (400-mil) Molded SOJ (Pb-Free)	
	CY7C1041CV33-12ZC	51-85087	44-pin TSOP II	
	CY7C1041CV33-12ZXC		44-pin TSOP II (Pb-Free)	
	CY7C1041CV33-12VXI	51-85082	44-lead (400-mil) Molded SOJ (Pb-Free)	Industrial
	CY7C1041CV33-12ZI	51-85087	44-pin TSOP II	
	CY7C1041CV33-12ZXI		44-pin TSOP II (Pb-Free)	
15	CY7C1041CV33-15VC	51-85082	44-lead (400-mil) Molded SOJ	Commercial
	CY7C1041CV33-15VXC		44-lead (400-mil) Molded SOJ (Pb-Free)	
	CY7C1041CV33-15ZC	51-85087	44-pin TSOP II	
	CY7C1041CV33-15ZXC		44-pin TSOP II (Pb-Free)	
	CY7C1041CV33-15VI	51-85082	44-lead (400-mil) Molded SOJ	Industrial
	CY7C1041CV33-15VXI		44-lead (400-mil) Molded SOJ (Pb-Free)	
	CY7C1041CV33-15ZI	51-85087	44-pin TSOP II	
	CY7C1041CV33-15ZXI		44-pin TSOP II (Pb-Free)	
20	CY7C1041CV33-20ZC	51-85087	44-pin TSOP II	Commercial
	CY7C1041CV33-20ZXC		44-pin TSOP II (Pb-Free)	
	CY7C1041CV33-20ZSXA		44-pin TSOP II (Pb-Free)	Automotive-A
	CY7C1041CV33-20VE	51-85082	44-lead (400-mil) Molded SOJ	Automotive-E
	CY7C1041CV33-20VXE		44-lead (400-mil) Molded SOJ (Pb-Free)	
	CY7C1041CV33-20ZE	51-85087	44-pin TSOP II	
	CY7C1041CV33-20ZSXE		44-pin TSOP II (Pb-Free)	

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

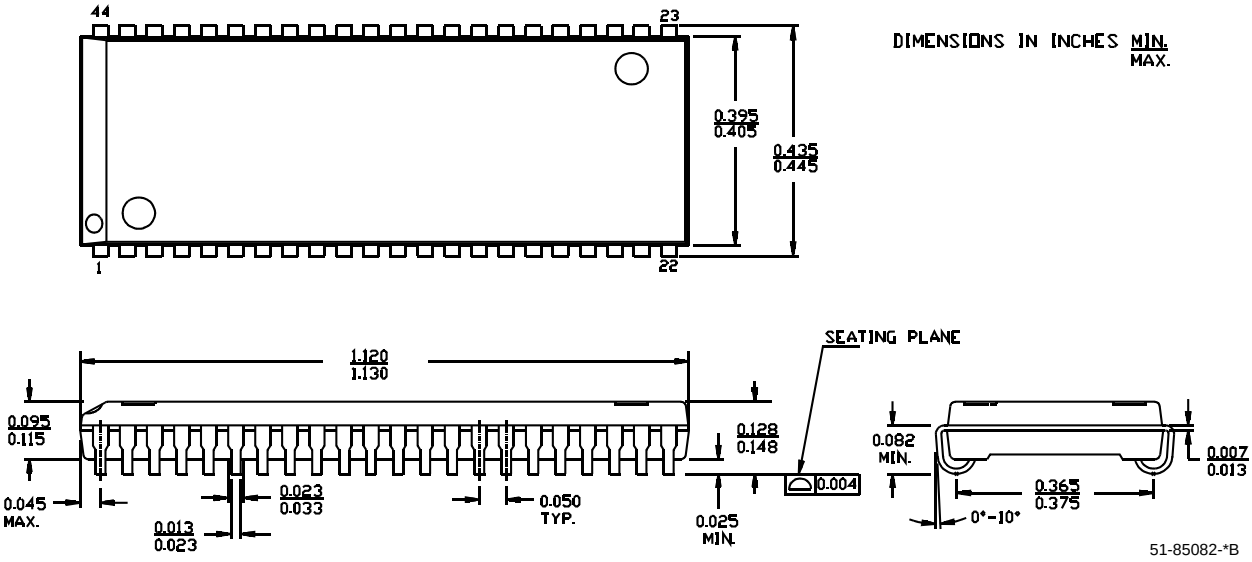
Package Diagrams

48-Ball (7.00 mm x 8.5 mm x 1.2 mm) FBGA (51-85106)

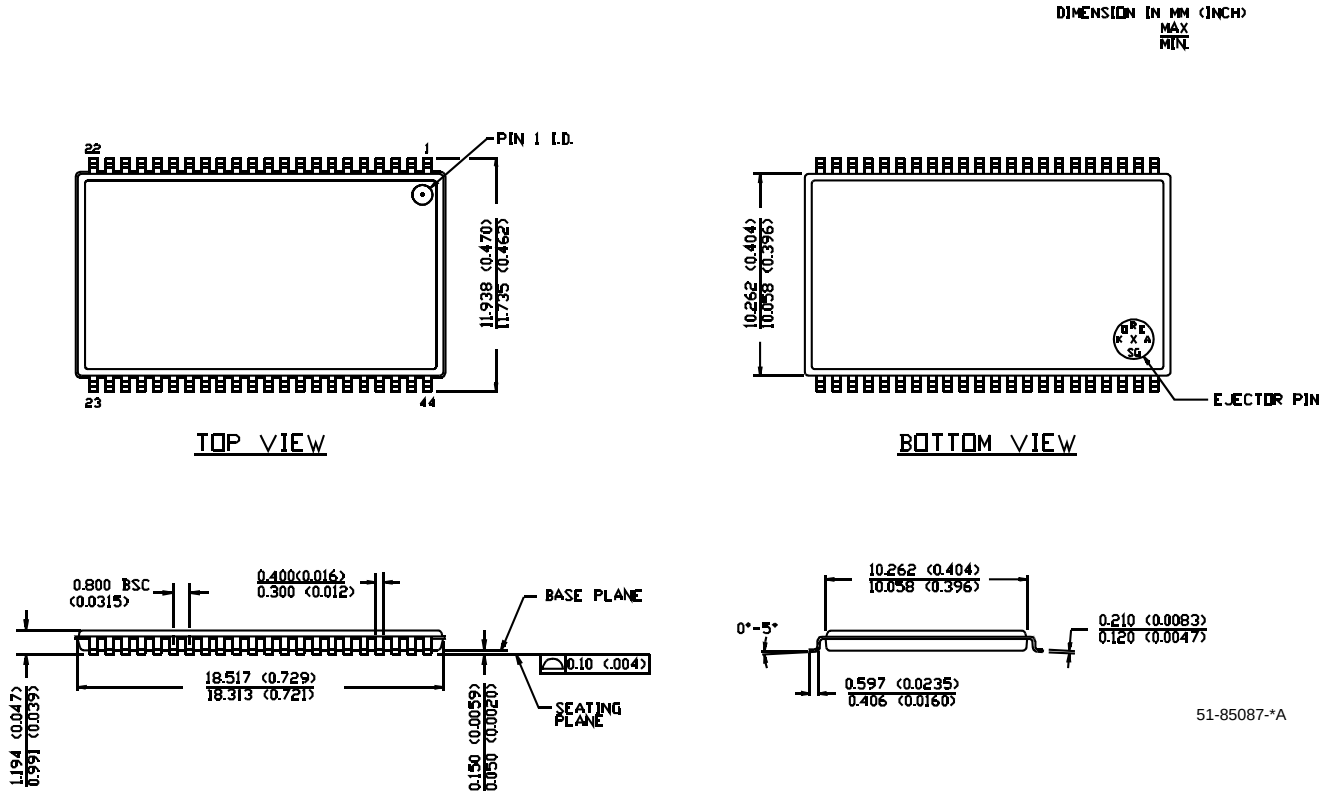


Package Diagrams (continued)

44-lead (400-mil) Molded SOJ (51-85082)



44-pin TSOP II (51-85087)



Document History Page

Document Title: CY7C1041CV33 4-Mbit (256K x 16) Static RAM Document Number: 38-05134				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	109513	12/13/01	HGK	New Data Sheet
*A	112440	12/20/01	BSS	Updated 51-85106 from revision *A to *C
*B	112859	03/25/02	DFP	Added CY7C1042CV33 in BGA package Removed 1042 BGA option pin ACC Final Data Sheet
*C	116477	09/16/02	CEA	Add applications foot note to data sheet
*D	119797	10/21/02	DFP	Added 20-ns speed bin
*E	262949	See ECN	RKF	1) Added Lead (Pb)-Free parts in the Ordering info (Page #9) 2) Added Automotive Specs to Datasheet
*F	361795	See ECN	SYT	Added Pb-Free offerings in the Ordering Information
*G	435387	See ECN	NXR	Removed -8 Speed bin from Product offering. Corrected typo in description for $\overline{BH}$E/BLE in pin definitions table on Page# 3 corrected ther Pin name from $\overline{OE2}$ to OE. Included the Maximum Ratings for Static Discharge Voltage and Latch up Current. Changed the description of I_{IX} current from Input Load Current to Input Leakage Current Added note# 4 on page# 4 Updated the Ordering Information table
*H	499153	See ECN	NXR	Added Automotive-A Operating Range Changed t_{power} value from 1 µs to 100 µs Updated Ordering Information table