



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: -40°C to 125°C
- High speed
 - $t_{AA} = 10 \text{ ns}$
- 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

Functional Description^[1]

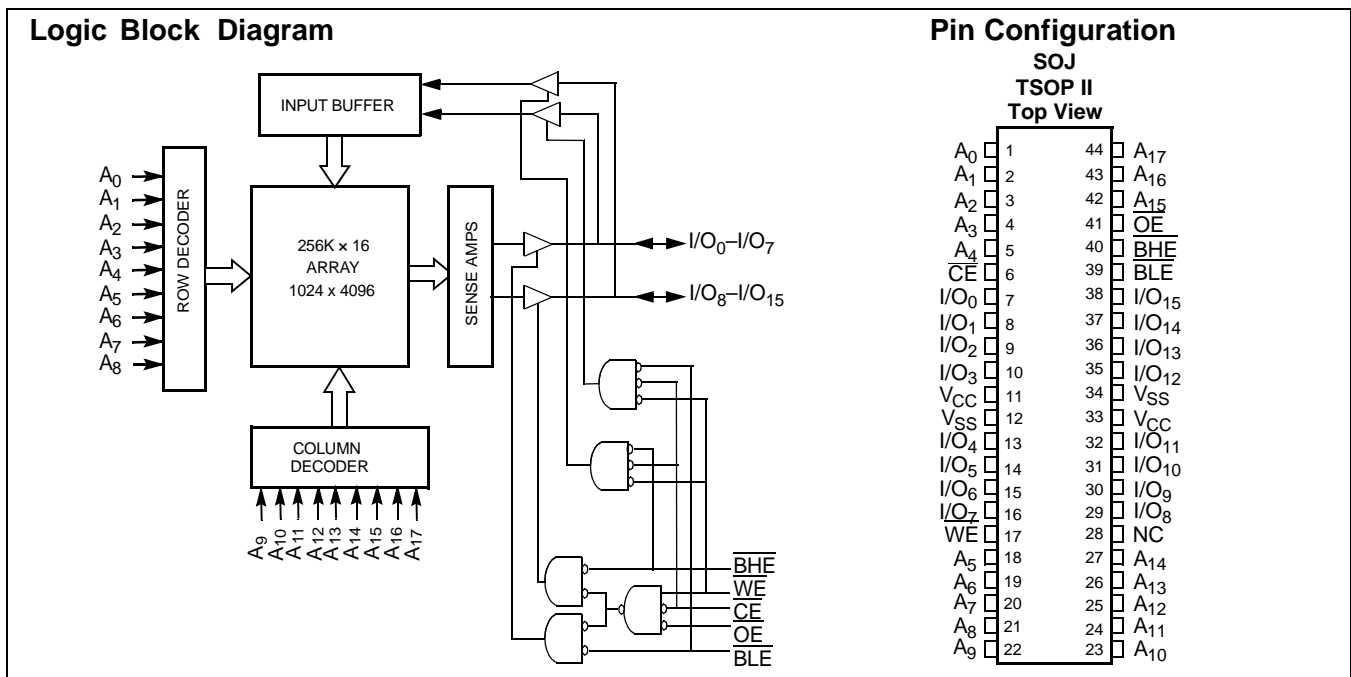
The CY7C1041CV33 is a high-performance CMOS Static RAM organized as 262,144 words by 16 bits.

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.



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.

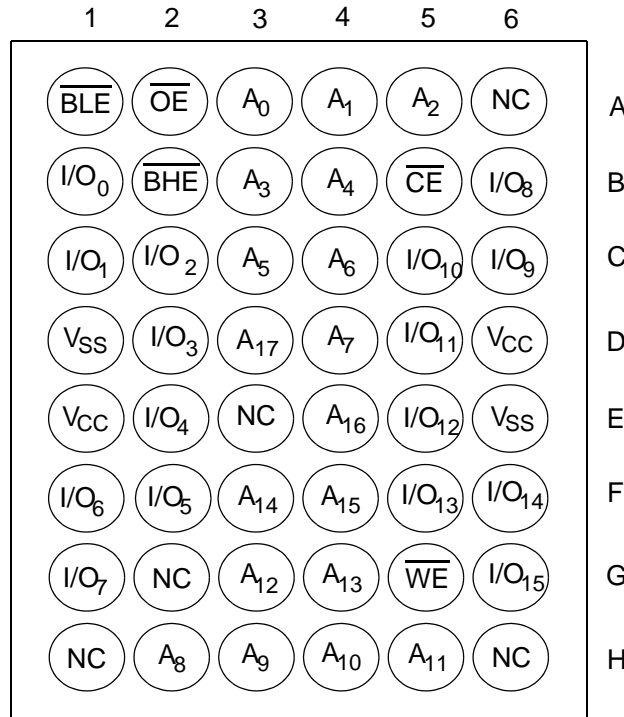
Selection Guide

		-8	-10	-12	-15	-20	Unit
Maximum Access Time		8	10	12	15	20	ns
Maximum Operating Current	Commercial	100	90	85	80	75	mA
	Industrial	110	100	95	90	85	mA
	Automotive	-	-	-	-	90	mA
Maximum CMOS Standby Current	Commercial/ Industrial	10	10	10	10	10	mA
	Automotive	-	-	-	-	15	mA

Shaded areas contain advance information.

Pin Configurations

**48-ball Mini 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,G 3,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,E 2,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 ^[2]	28	A6,E3,G2,H1, H6	No Connect	No Connects. This pin is not connected to the die
$\overline{\text{WE}}$	17	G5	Input/Control	Write Enable Input, active LOW. When selected LOW, a WRITE is conducted. When selected HIGH, a READ is conducted.
$\overline{\text{CE}}$	6	B5	Input/Control	Chip Enable Input, active LOW. When LOW, selects the chip. When HIGH, deselects the chip.
$\overline{\text{BHE}}$, $\overline{\text{BLE}}$	39,40	A1,B2	Input/Control	Byte Write Select Inputs, active LOW. $\overline{\text{BHE}}$ controls I/O ₇ -I/O ₀ , $\overline{\text{BLE}}$ controls I/O ₁₅ -I/O ₈ .
$\overline{\text{OE2}}$	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 three-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.

Note:

- NC pins are not connected on the die.

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^[3] -0.5V to +4.6V

DC Voltage Applied to Outputs in High-Z State^[3] -0.5V to V_{CC} + 0.5V

DC Input Voltage^[3] -0.5V to V_{CC} + 0.5V

Current into Outputs (LOW) 20 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	-40°C to +125°C	

DC Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	-8		-10		-12		-15		-20		Unit	
			Min.	Max.	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		2.4		V	
V _{OL}	Output LOW Voltage	V _{CC} = Min., I _{OL} = 8.0 mA		0.4		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	2.0	V _{CC} + 0.3	V	
V _{IL} ^[3]	Input LOW Voltage		-0.3	0.8	-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}	Com'l / Ind'l	-1	+1	-1	+1	-1	+1	-1	+1	-1	+1	μA
			Automotive									-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	-1	+1	μA
			Automotive									-20	+20	μA
I _{CC}	V _{CC} Operating Supply Current	V _{CC} = Max., f = f _{MAX} = 1/t _{RC}	Comm'l		100		90		85		80		75	mA
			Ind'l		110		100		95		90		85	mA
			Automotive											90
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}	Com'l / Ind'l		40		40		40		40		40	mA
			Automotive										45	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	Com'l / Ind'l		10		10		10		10		10	mA
			Automotive										15	mA

Shaded areas contain advance information.

Capacitance^[4]

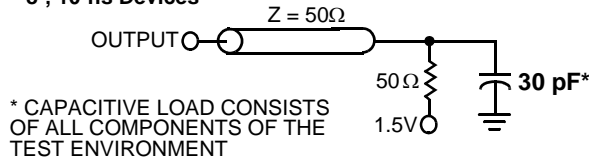
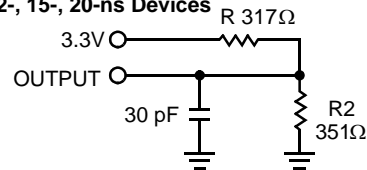
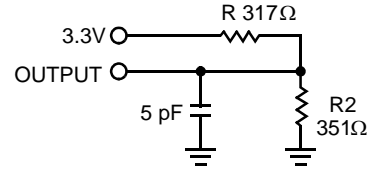
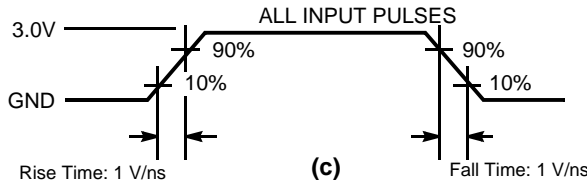
Parameter	Description	Test Conditions	Max.	Unit
C _{IN}	Input Capacitance	T _A = 25°C, f = 1 MHz, V _{CC} = 3.3V	8	pF
C _{OUT}	I/O Capacitance		8	pF

Thermal Resistance^[4]

Parameter	Description	Test Conditions	44-pin TSOP-II (Non Pb-Free)	48-FBGA (Non Pb-Free)	Unit
Θ _{JA}	Thermal Resistance (Junction to Ambient)	Test conditions follow standard test methods and procedures for measuring thermal impedance, per EIA / JESD51.	76.85	92.78	°C/W
Θ _{JC}	Thermal Resistance (Junction to Case)		11.26	8.88	°C/W

Notes:

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

AC Test Loads and Waveforms^[11]
8-, 10-ns Devices

(a)
12-, 15-, 20-ns Devices

(b)
High-Z Characteristics

(d)

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

Parameter	Description	-8		-10		-12		-15		-20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle												
$t_{power}^{[6]}$	V_{CC} (typical) to the first access	1		1		1		1		1		μs
t_{RC}	Read Cycle Time	8		10		12		15		20		ns
t_{AA}	Address to Data Valid		8		10		12		15		20	ns
t_{OHA}	Data Hold from Address Change	3		3		3		3		3		ns
t_{ACE}	\overline{CE} LOW to Data Valid		8		10		12		15		20	ns
t_{DOE}	\overline{OE} LOW to Data Valid		4		5		6		7		8	ns
t_{LZOE}	\overline{OE} LOW to Low-Z	0		0		0		0		0		ns
t_{HZOE}	\overline{OE} HIGH to High-Z ^[7, 8]		4		5		6		7		8	ns
t_{LZCE}	\overline{CE} LOW to Low-Z ^[8]	3		3		3		3		3		ns
t_{HZCE}	\overline{CE} HIGH to High-Z ^[7, 8]		4		5		6		7		8	ns
t_{PU}	\overline{CE} LOW to Power-Up	0		0		0		0		0		ns
t_{PD}	\overline{CE} HIGH to Power-Down		8		10		12		15		20	ns
t_{DBE}	Byte Enable to Data Valid		4		5		6		7		8	ns
t_{LZBE}	Byte Enable to Low-Z	0		0		0		0		0		ns
t_{HZBE}	Byte Disable to High-Z		6		6		6		7		8	ns
Write Cycle^[9, 10]												
t_{WC}	Write Cycle Time	8		10		12		15		20		ns
t_{SCE}	\overline{CE} LOW to Write End	6		7		8		10		10		ns
t_{AW}	Address Set-Up to Write End	6		7		8		10		10		ns

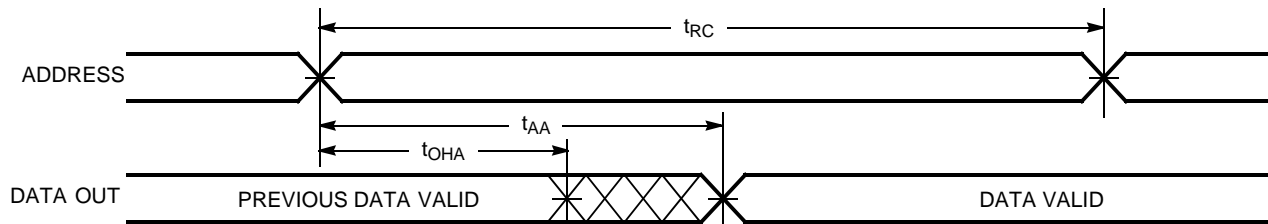
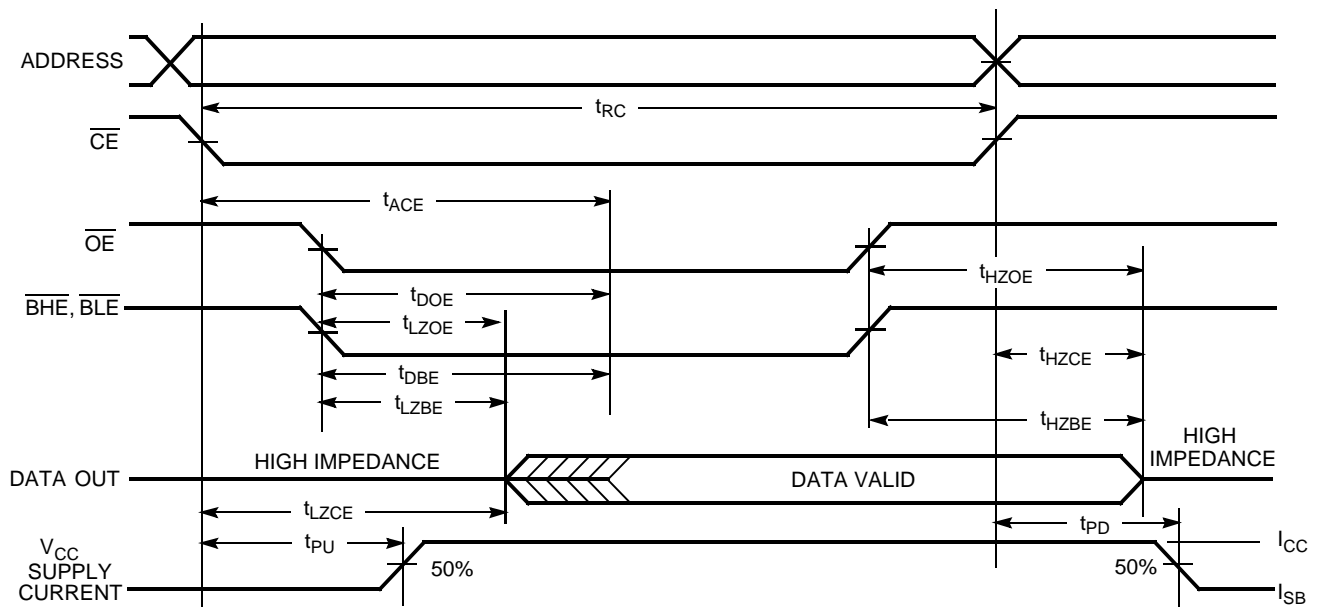
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Notes:

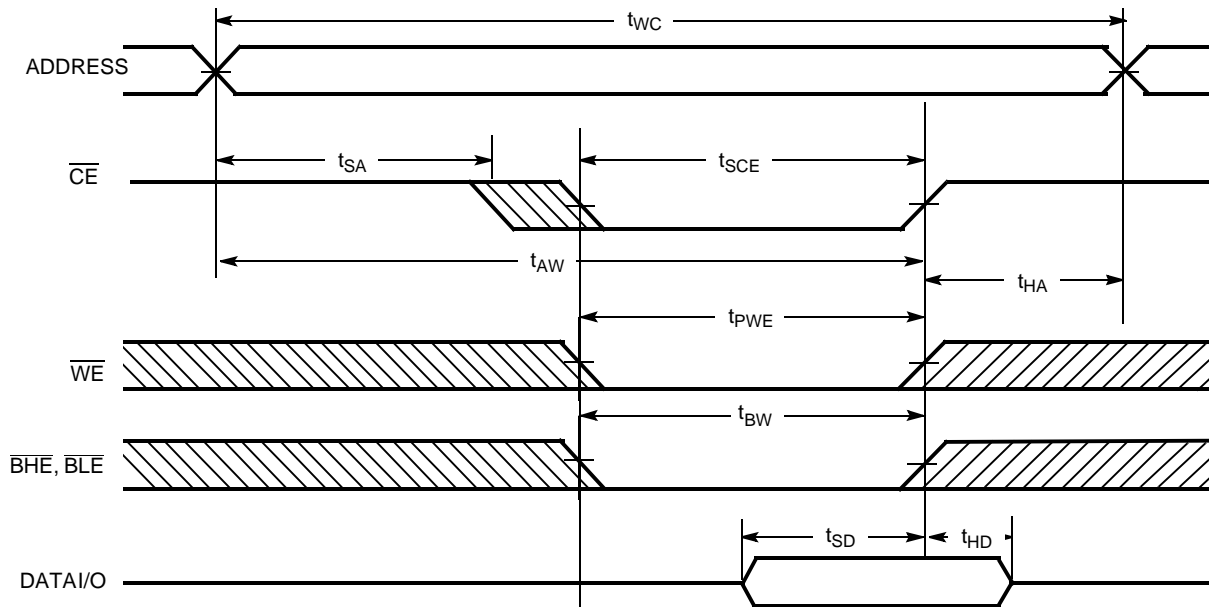
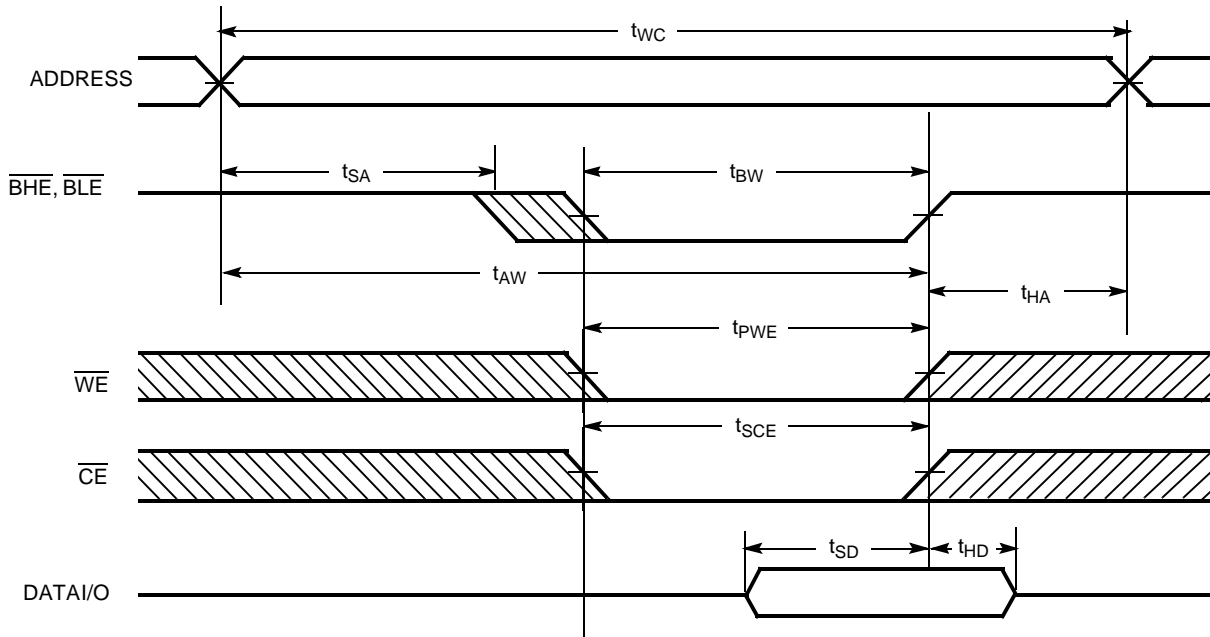
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V.
- t_{POWER} gives the minimum amount of time that the power supply should be at typical V_{CC} values until the first memory access can be performed.
- t_{HZOE} , t_{HZCE} , 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.
- 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 \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.
- 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} .

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

Parameter	Description	-8		-10		-12		-15		-20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
t_{HA}	Address Hold from Write End	0		0		0		0		0		ns
t_{SA}	Address Set-Up to Write Start	0		0		0		0		0		ns
t_{PWE}	\overline{WE} Pulse Width	6		7		8		10		10		ns
t_{SD}	Data Set-Up to Write End	4		5		6		7		8		ns
t_{HD}	Data Hold from Write End	0		0		0		0		0		ns
t_{LZWE}	\overline{WE} HIGH to Low-Z ^[8]	3		3		3		3		3		ns
t_{HZWE}	\overline{WE} LOW to High-Z ^[7, 8]		4		5		6		7		8	ns
t_{BW}	Byte Enable to End of Write	6		7		8		10		10		ns

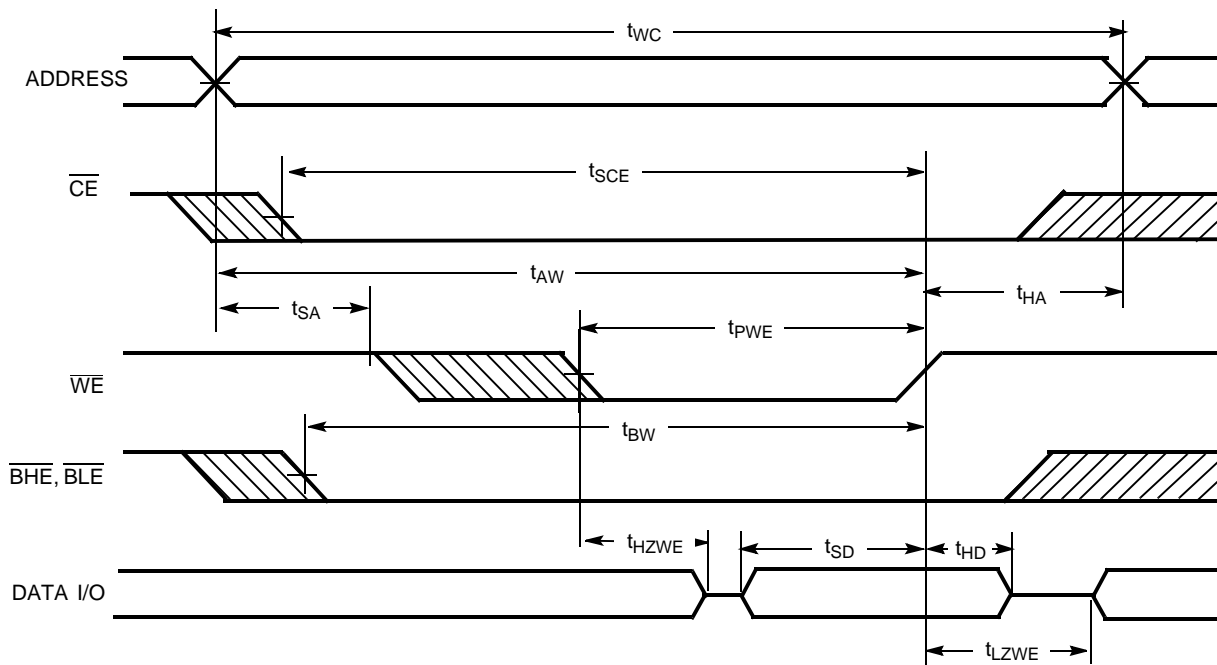
Switching Waveforms
Read Cycle No. 1^[12, 13]

Read Cycle No. 2 (\overline{OE} Controlled)^[13, 14]

Notes:

11. AC characteristics (except High-Z) for all 8-ns and 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).
12. Device is continuously selected. OE, CE, BHE and/or BHE = V_{IL} .
13. WE is HIGH for Read cycle.
14. Address valid prior to or coincident with \overline{CE} transition LOW.

Switching Waveforms (continued)
Write Cycle No. 1 ($\overline{\text{CE}}$ Controlled)^[15, 16]

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

Notes:

15. Data I/O is high-impedance if $\overline{\text{OE}}$ or $\overline{\text{BHE}}$ and/or $\overline{\text{BLE}} = V_{\text{IH}}$.
 16. 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. 2 (\overline{WE} Controlled, \overline{OE} LOW)

Truth Table

CE	OE	WE	BLE	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 Name	Package Type	Operating Range	
10	CY7C1041CV33-10BAC	BA48B	48-ball Fine Pitch BGA	Commercial	
	CY7C1041CV33-10BAXC	BA48B	48-ball Fine Pitch BGA (Pb-Free)		
	CY7C1041CV33-10VC	V34	44-lead (400-mil) Molded SOJ		
	CY7C1041CV33-10VXC	V34	44-lead (400-mil) Molded SOJ (Pb-Free)		
	CY7C1041CV33-10ZC	Z44	44-pin TSOP II Z44		
	CY7C1041CV33-10ZXC	Z44	44-pin TSOP II Z44 (Pb-Free)		
	10	CY7C1041CV33-10BAI	BA48B	48-ball Fine Pitch BGA	Industrial
		CY7C1041CV33-10BAXI	BA48B	48-ball Fine Pitch BGA (Pb-Free)	
		CY7C1041CV33-10VI	V34	44-lead (400-mil) Molded SOJ	
		CY7C1041CV33-10ZI	Z44	44-pin TSOP II Z44	
		CY7C1041CV33-10ZXI	Z44	44-pin TSOP II Z44 (Pb-Free)	
12	CY7C1041CV33-12BAC	BA48B	48-ball Fine Pitch BGA	Commercial	
	CY7C1041CV33-12VC	V34	44-lead (400-mil) Molded SOJ		
	CY7C1041CV33-12VXC	V34	44-lead (400-mil) Molded SOJ (Pb-Free)		
	CY7C1041CV33-12ZC	Z44	44-pin TSOP II Z44		
	CY7C1041CV33-12ZXC	Z44	44-pin TSOP II Z44 (Pb-Free)		
	12	CY7C1041CV33-12BAI	BA48B	48-ball Fine Pitch BGA	Industrial
		CY7C1041CV33-12BAXI	BA48B	48-ball Fine Pitch BGA (Pb-Free)	
		CY7C1041CV33-12VI	V34	44-lead (400-mil) Molded SOJ	
		CY7C1041CV33-12VXI	V34	44-lead (400-mil) Molded SOJ	
		CY7C1041CV33-12ZI	Z44	44-pin TSOP II Z44	
		CY7C1041CV33-12ZXI	Z44	44-pin TSOP II Z44 (Pb-Free)	
15	CY7C1041CV33-15BAC	BA48B	48-ball Fine Pitch BGA	Commercial	
	CY7C1041CV33-15VC	V34	44-lead (400-mil) Molded SOJ		
	CY7C1041CV33-15VXC	V34	44-lead (400-mil) Molded SOJ (Pb-Free)		
	CY7C1041CV33-15ZC	Z44	44-pin TSOP II Z44		
	CY7C1041CV33-15ZXC	Z44	44-pin TSOP II Z44 (Pb-Free)		
	15	CY7C1041CV33-15BAI	BA48B	48-ball Fine Pitch BGA	Industrial
		CY7C1041CV33-15VI	V34	44-lead (400-mil) Molded SOJ	
		CY7C1041CV33-15VXI	V34	44-lead (400-mil) Molded SOJ (Pb-Free)	
		CY7C1041CV33-15ZI	Z44	44-pin TSOP II Z44	
		CY7C1041CV33-15ZXI	Z44	44-pin TSOP II Z44 (Pb-Free)	
20	CY7C1041CV33-20BAC	BA48B	48-ball Fine Pitch BGA	Commercial	
	CY7C1041CV33-20VC	V34	44-lead (400-mil) Molded SOJ		
	CY7C1041CV33-20VXC	V34	44-lead (400-mil) Molded SOJ (Pb-Free)		
	CY7C1041CV33-20ZC	Z44	44-pin TSOP II Z44		
	CY7C1041CV33-20ZXC	Z44	44-pin TSOP II Z44 (Pb-Free)		
	20	CY7C1041CV33-20BAI	BA48B	48-ball Fine Pitch BGA	Industrial
		CY7C1041CV33-20VI	V34	44-lead (400-mil) Molded SOJ	
		CY7C1041CV33-20ZI	Z44	44-pin TSOP II Z44	
		CY7C1041CV33-20ZXI	Z44	44-pin TSOP II Z44 (Pb-Free)	

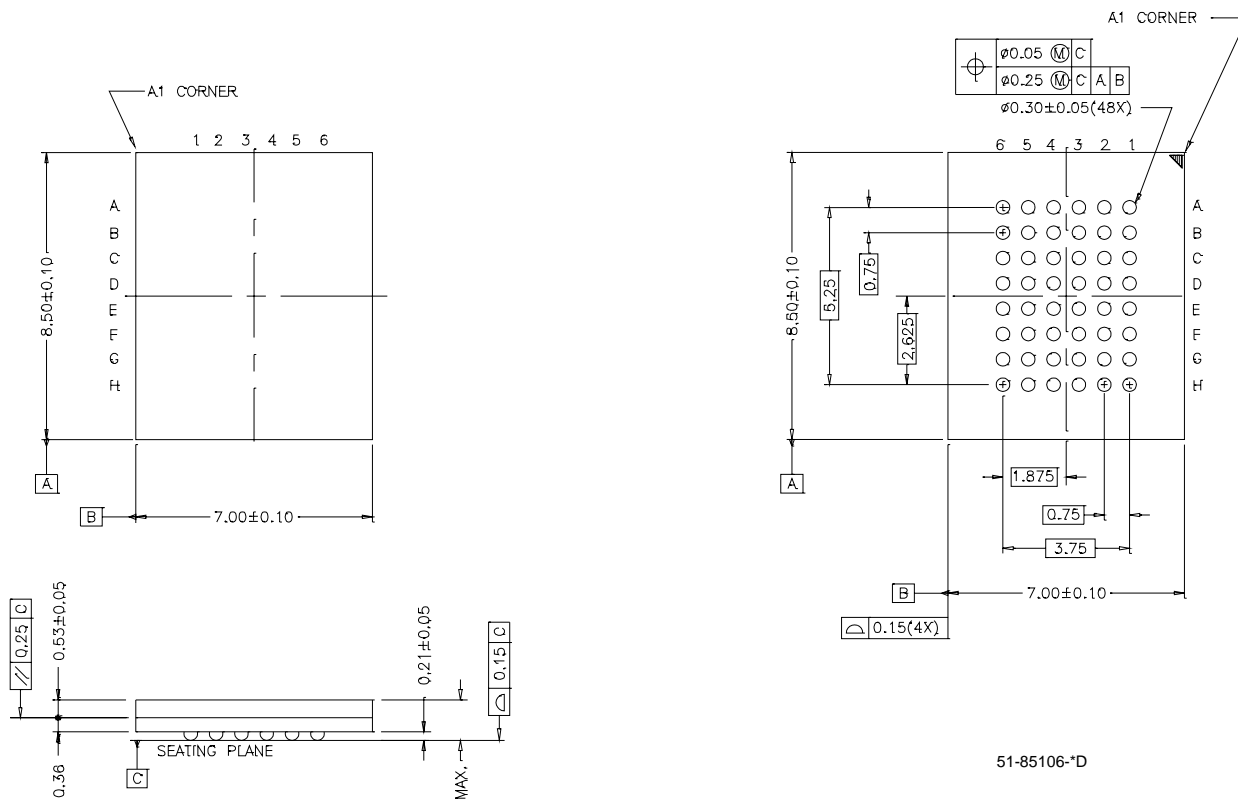
Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
20	CY7C1041CV33-20BAE	BA48B	48-ball Fine Pitch BGA	Automotive
	CY7C1041CV33-20VE	V34	44-lead (400-mil) Molded SOJ	
	CY7C1041CV33-20VXE	V34	44-lead (400-mil) Molded SOJ (Pb-Free)	
	CY7C1041CV33-20ZE	Z44	44-pin TSOP II Z44	
	CY7C1041CV33-20ZSXE	Z44	44-pin TSOP II Z44 (Pb-Free)	

Package Diagrams
48-ball (7.00 mm x 8.5 mm x 1.2 mm) FBGA BA48B

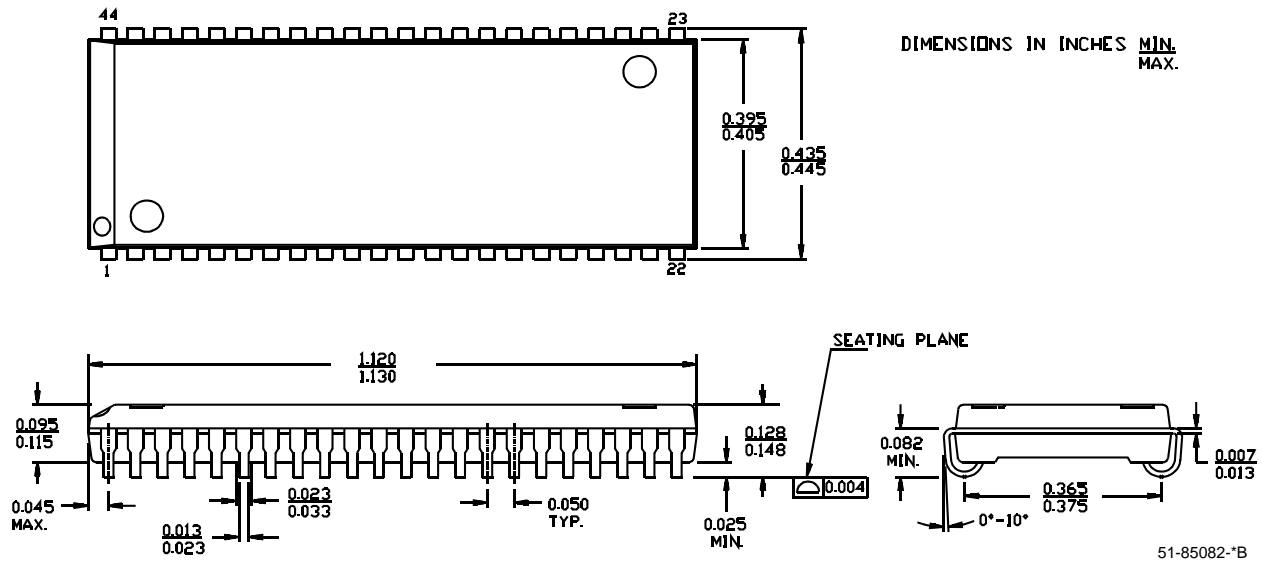
TOP VIEW

BOTTOM VIEW

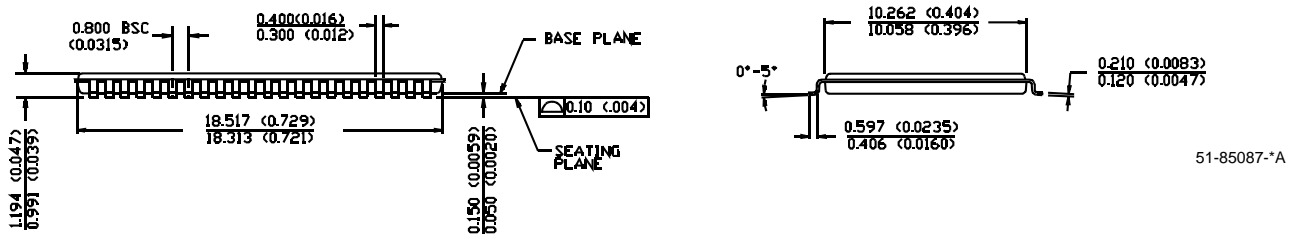
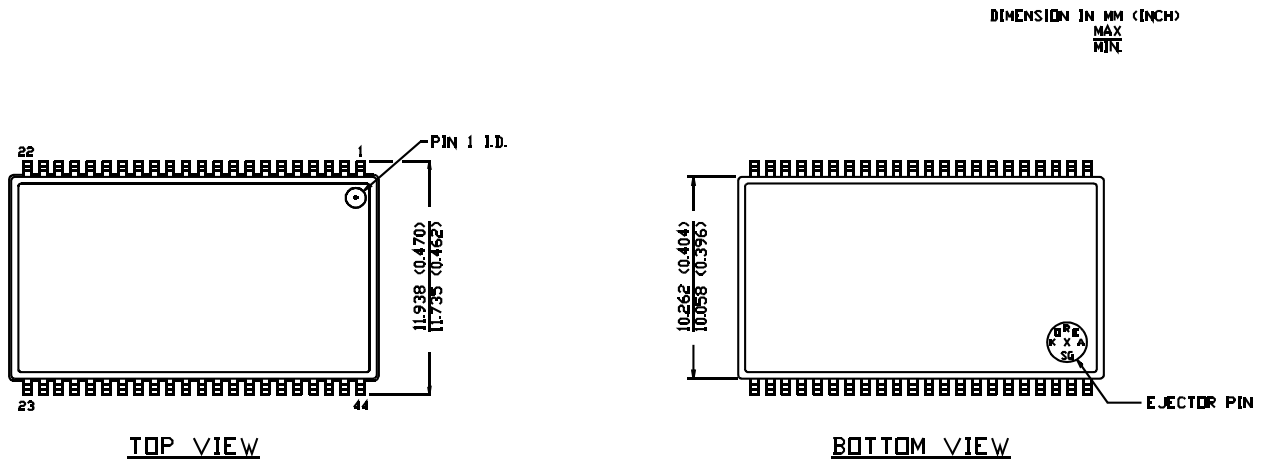


Package Diagrams (continued)

44-lead (400-mil) Molded SOJ V34



44-pin TSOP II Z44



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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