

1-Mbit (64 K x 16) Static RAM

Features

- Temperature ranges
 - Industrial: -40 °C to 85 °C
 - Automotive-A: -40 °C to 85 °C
- Pin-and function-compatible with CY7C1021CV33
- High speed
 - $t_{AA} = 10 \text{ ns}$
- Low active power
 - $I_{CC} = 60 \text{ mA @ } 10 \text{ ns}$
- Low CMOS standby power
 - $I_{SB2} = 3 \text{ mA}$
- 2.0 V 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]

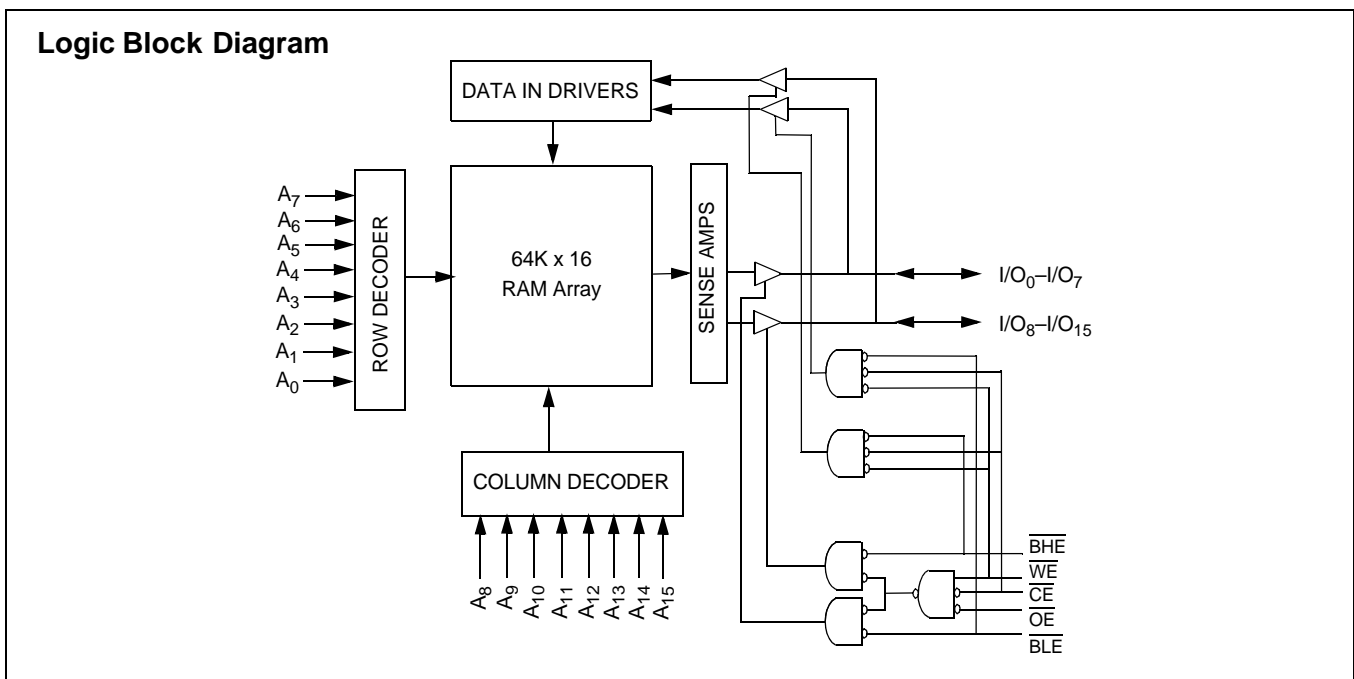
The CY7C1021DV33 is a high-performance CMOS static RAM organized as 65,536 words by 16 bits. This device has an automatic power-down feature that significantly reduces power consumption when deselected.

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 \overline{BHE} and \overline{BLE} are disabled (\overline{BHE} , \overline{BLE} HIGH), or during a Write operation (\overline{CE} LOW, and \overline{WE} LOW).

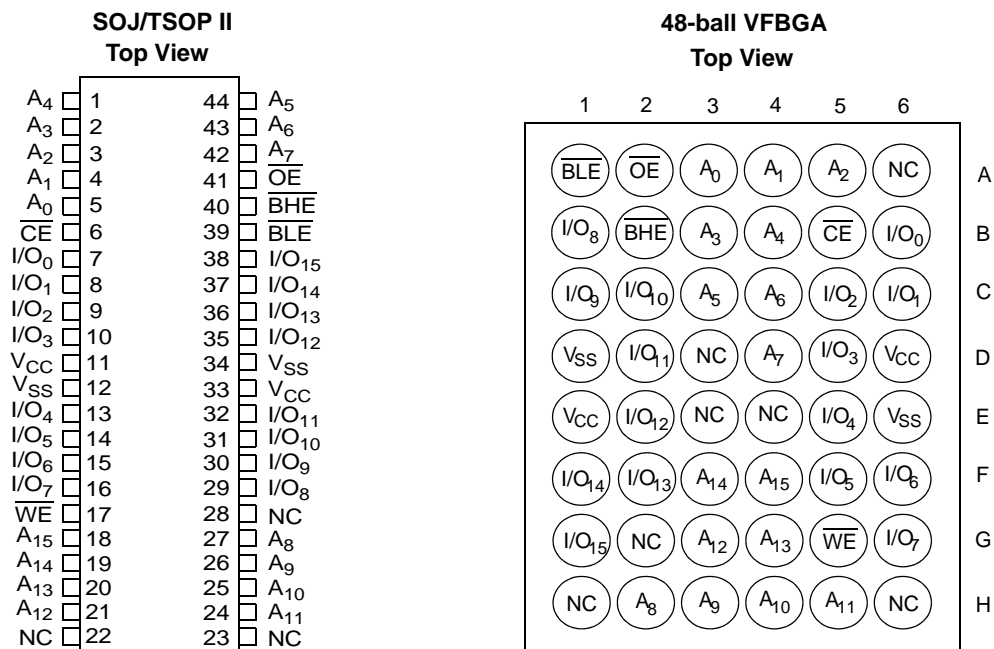
The CY7C1021DV33 is available in Pb-free 44-pin 400-Mil wide Molded SOJ, 44-pin TSOP II and 48-ball VFBGA packages.



Selection Guide

	-10 (Industrial/Automotive-A)	Unit
Maximum access time	10	ns
Maximum operating current	60	mA
Maximum CMOS standby current	3	mA

Pin Configuration^[1]



Notes

1. 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 ^[2] ...	-0.3 V to +4.6 V
DC Voltage applied to outputs in high-Z State ^[2]	-0.3 V to V _{CC} +0.3 V
DC input voltage ^[2]	-0.3 V to V _{CC} +0.3 V

Current into outputs (LOW)	20 mA
Static discharge voltage.....	> 2001 V (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	3.3 V ± 0.3 V	10 ns
Automotive-A	-40 °C to +85°C		10 ns

DC Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	-10 (Ind/I/Auto-A)		Unit
			Min.	Max.	
V _{OH}	Output HIGH voltage	V _{CC} = Min., I _{OH} = -4.0 mA	2.4		V
V _{OL}	Output LOW voltage	V _{CC} = Min., I _{OL} = 8.0 mA		0.4	V
V _{IH}	Input HIGH voltage		2.0	V _{CC} + 0.3	V
V _{IL}	Input LOW voltage ^[2]		-0.3	0.8	V
I _{IX}	Input leakage current	GND ≤ V _I ≤ V _{CC}	-1	+1	μA
I _{OZ}	Output leakage current	GND ≤ V _I ≤ V _{CC} , Output Disabled	-1	+1	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	mA
			66 MHz	45	mA
			40 MHz	30	mA
I _{SB1}	Automatic CE Power-Down Current —TTL Inputs	Max. V _{CC} , $\overline{CE} \geq V_{IH}$ V _{IN} ≥ V _{IH} or V _{IN} ≤ V _{IL} , f = f _{MAX}		10	mA
I _{SB2}	Automatic CE Power-Down Current —CMOS Inputs	Max. V _{CC} , $\overline{CE} \geq V_{CC} - 0.3 V$, V _{IN} ≥ V _{CC} - 0.3 V or V _{IN} ≤ 0.3 V, f = 0		3	mA

Capacitance^[3]

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

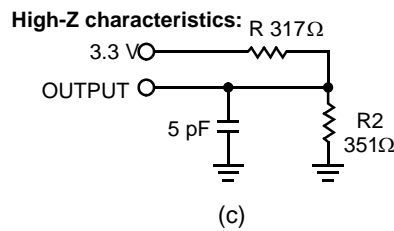
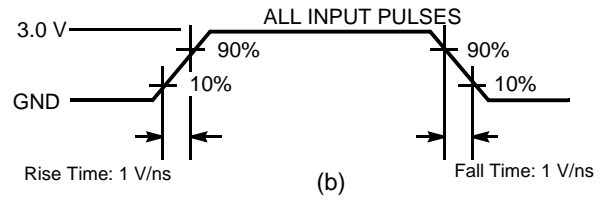
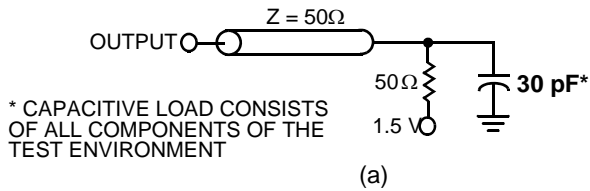
Thermal Resistance^[3]

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

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

AC Test Loads and Waveforms^[4]



Note

4. 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^[5]

Parameter	Description	-10 (Ind'I/Auto-A)		Unit
		Min.	Max.	
Read Cycle				
$t_{power}^{[6]}$	V_{CC} (typical) to the first access	100		μ s
t_{RC}	Read cycle time	10		ns
t_{AA}	Address to data valid		10	ns
t_{OHA}	Data hold from address change	3		ns
t_{ACE}	\overline{CE} LOW to data valid		10	ns
t_{DOE}	\overline{OE} LOW to data valid		5	ns
t_{LZOE}	\overline{OE} LOW to low-Z ^[8]	0		ns
t_{HZOE}	\overline{OE} HIGH to high-Z ^[7, 8]		5	ns
t_{LZCE}	\overline{CE} LOW to low-Z ^[8]	3		ns
t_{HZCE}	\overline{CE} HIGH to high-Z ^[7, 8]		5	ns
$t_{PU}^{[9]}$	\overline{CE} LOW to power-up	0		ns
$t_{PD}^{[9]}$	\overline{CE} HIGH to power-down		10	ns
t_{DBE}	Byte Enable to data valid		5	ns
t_{LZBE}	Byte Enable to low-Z	0		ns
t_{HZBE}	Byte Disable to high-Z		6	ns
Write Cycle^[10]				
t_{WC}	Write cycle time	10		ns
t_{SCE}	\overline{CE} LOW to write end	8		ns
t_{AW}	Address set-up to write end	8		ns
t_{HA}	Address hold from write end	0		ns
t_{SA}	Address set-up to write start	0		ns
t_{PWE}	\overline{WE} pulse width	7		ns
t_{SD}	Data set-up to write end	5		ns
t_{HD}	Data hold from write end	0		ns
t_{LZWE}	\overline{WE} HIGH to low-Z ^[8]	3		ns
t_{HZWE}	\overline{WE} LOW to high-Z ^[7, 8]		5	ns
t_{BW}	Byte enable to end of write	7		ns

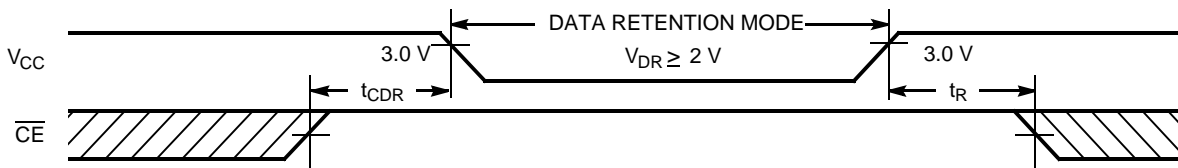
Notes

5. Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5 V, input pulse levels of 0 to 3.0 V.
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_{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.
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. This parameter is guaranteed by design and is not tested.
10. 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

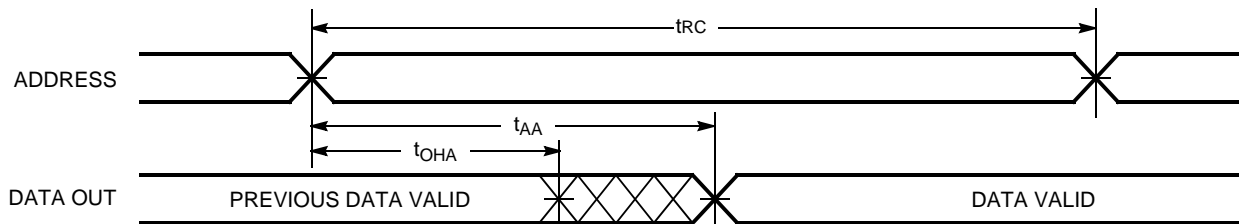
Parameter	Description	Conditions	Min.	Max.	Unit
V_{DR}	V_{CC} for data retention		2		V
I_{CCDR}	Data retention current	$V_{CC} = V_{DR} = 2.0\text{ V}$, $\overline{CE} \geq V_{CC} - 0.3\text{ V}$, $V_{IN} \geq V_{CC} - 0.3\text{ V}$ or $V_{IN} \leq 0.3\text{ V}$		3	mA
$t_{CDR}^{[3]}$	Chip deselect to data retention time		0		ns
$t_R^{[11]}$	Operation recovery time		t_{RC}		ns

Data Retention Waveform

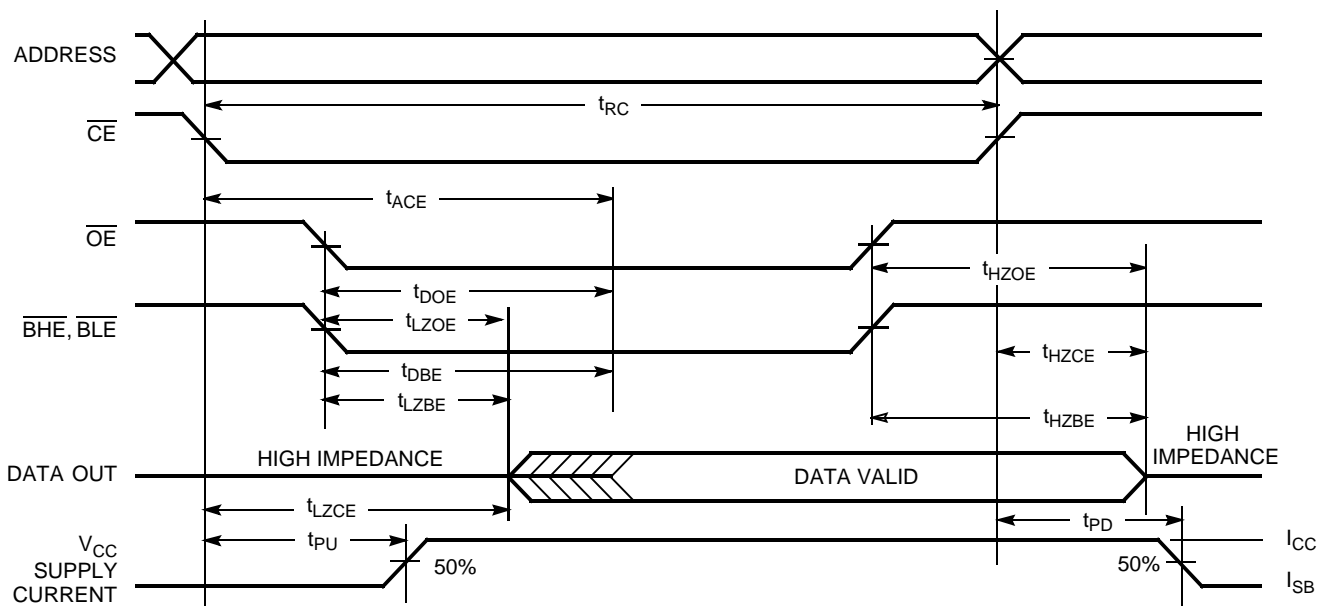


Switching Waveforms

Read Cycle No. 1 (Address Transition Controlled)^[12, 13]



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

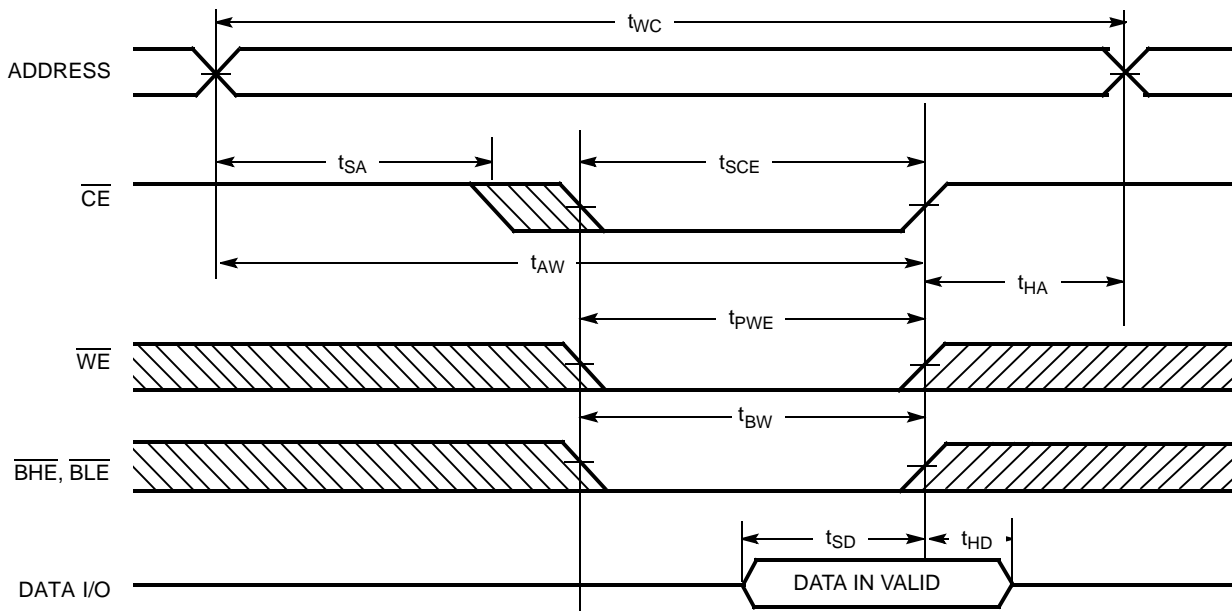


Notes

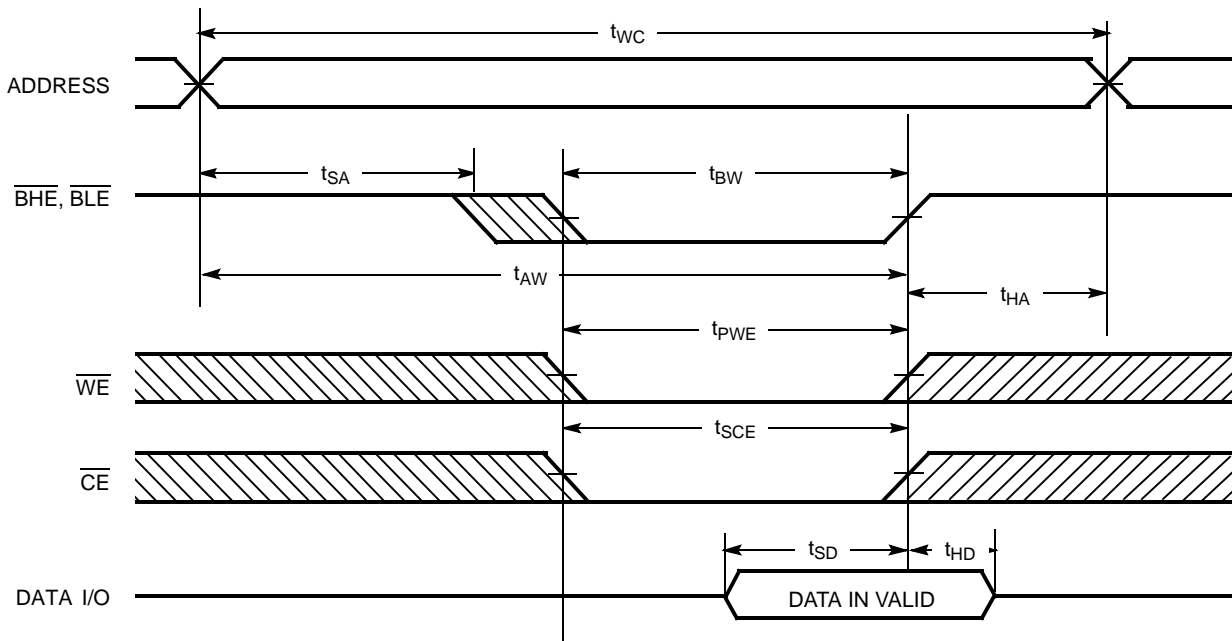
- 11. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} \geq 50\ \mu\text{s}$ or stable at $V_{CC(min.)} \geq 50\ \mu\text{s}$.
- 12. Device is continuously selected. \overline{OE} , \overline{CE} , \overline{BHE} and/or $\overline{BLE} = V_{IL}$.
- 13. \overline{WE} is HIGH 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)

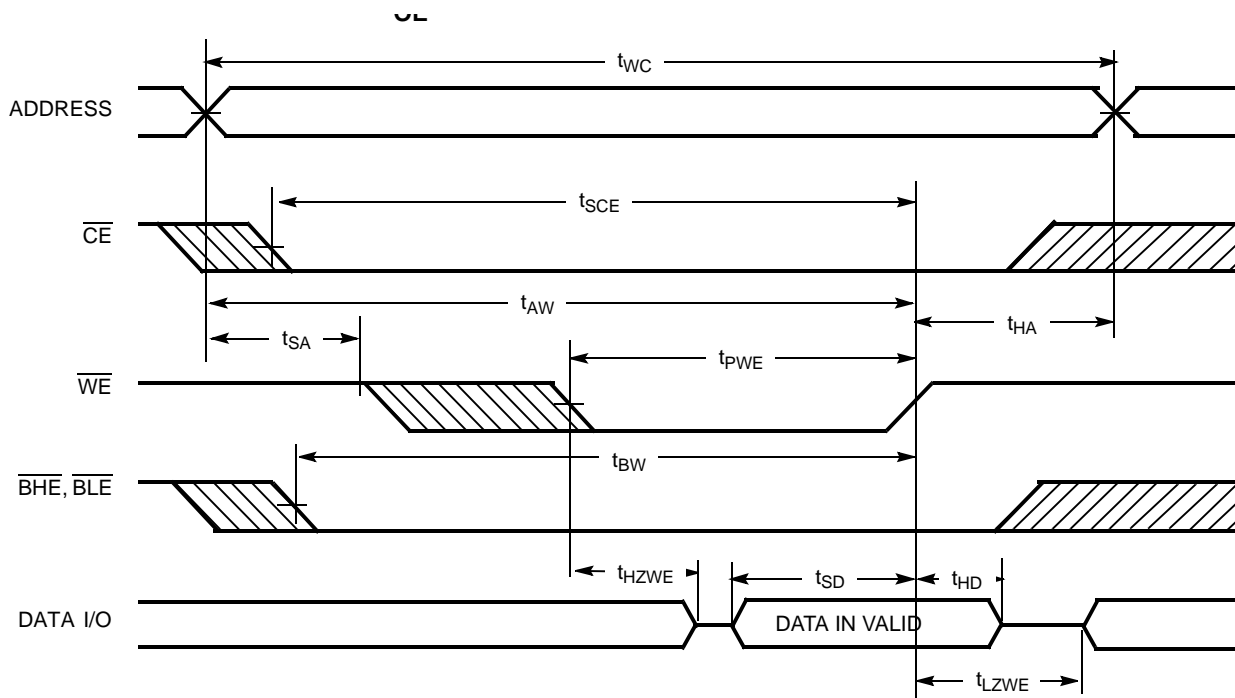


Notes

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



Truth Table

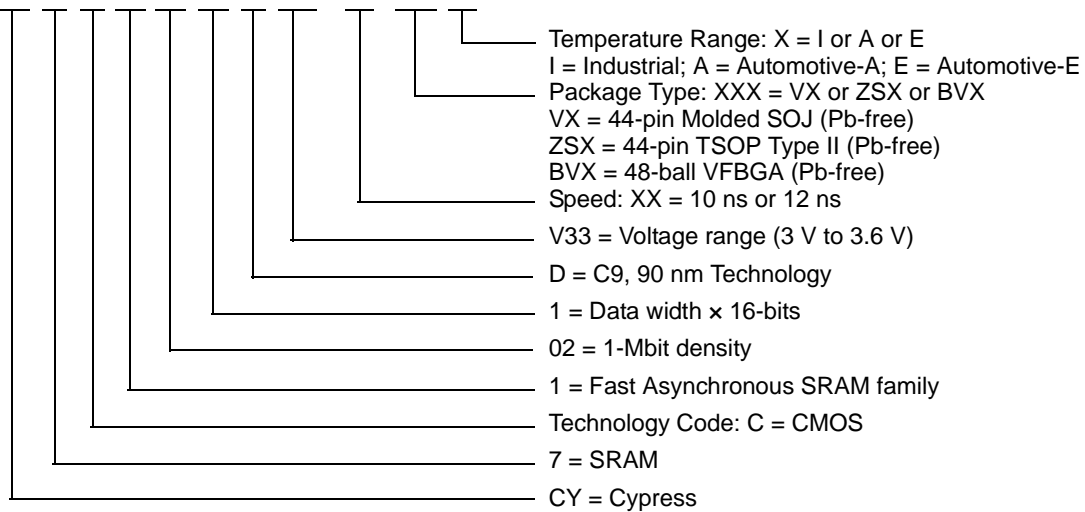
\overline{CE}	\overline{OE}	\overline{WE}	\overline{BLE}	\overline{BHE}	I/O ₀ -I/O ₇	I/O ₈ -I/O ₁₅	Mode	Power
H	X	X	X	X	High-Z	High-Z	Power-down	Standby (I_{SB})
L	L	H	L	L	Data Out	Data Out	Read – All bits	Active (I_{CC})
			L	H	Data Out	High-Z	Read – Lower bits only	Active (I_{CC})
			H	L	High-Z	Data 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})

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

Ordering Code Definitions

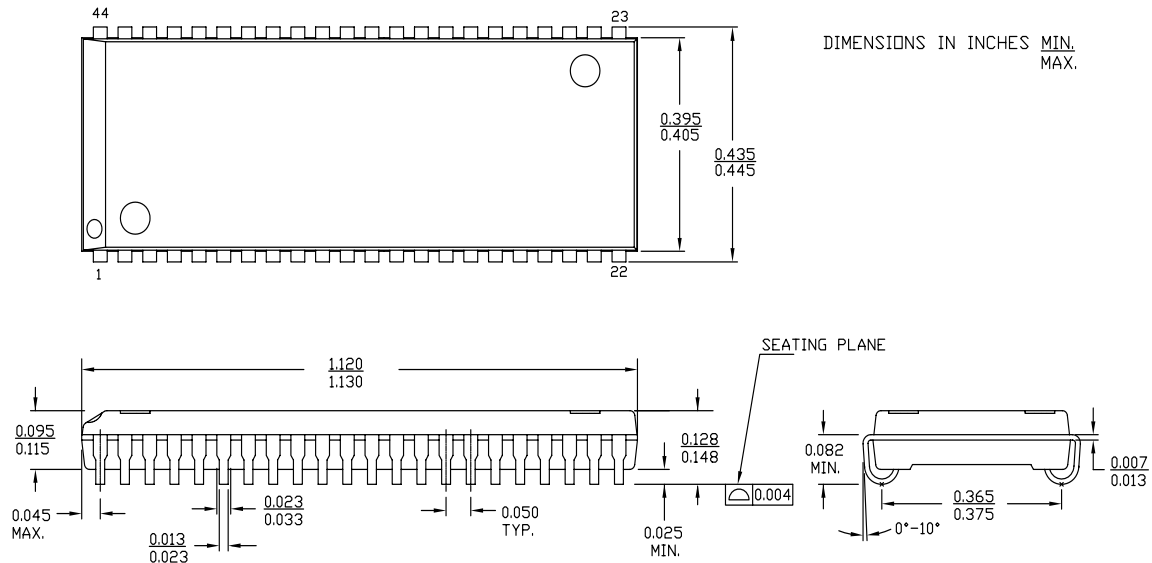
CY 7 C 1 02 1 D V33 - XX XXX X



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

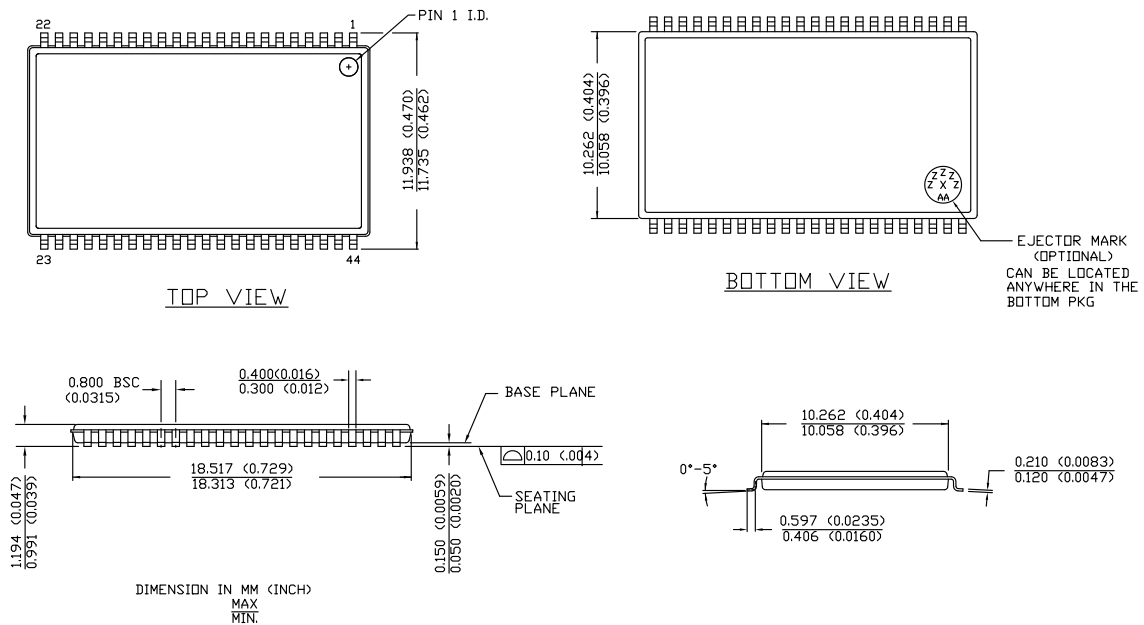
Package Diagrams

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



51-85082 *D

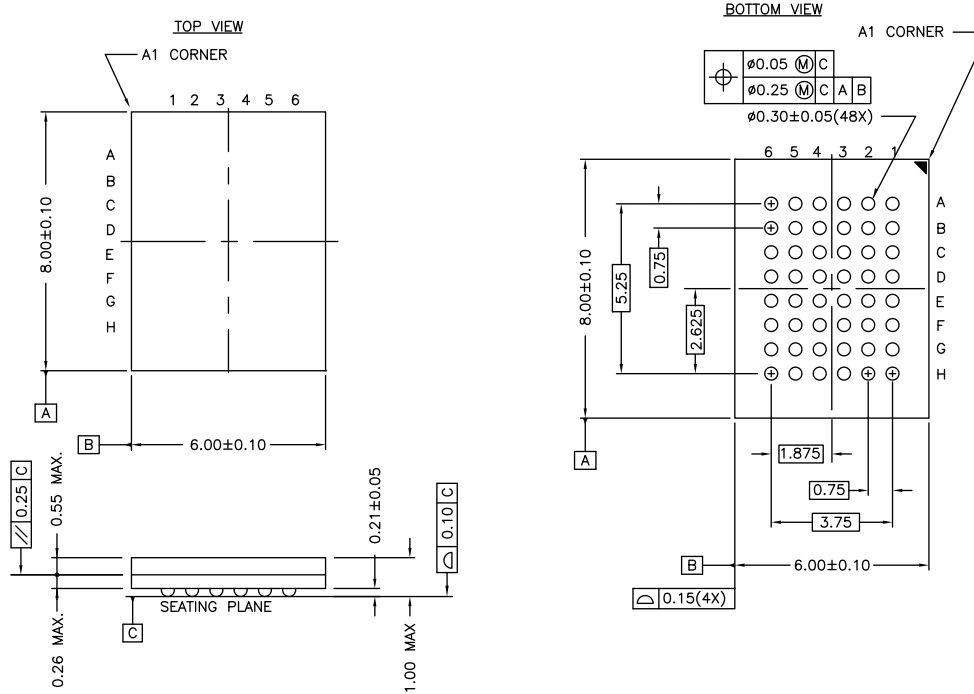
Figure 2. 44-pin Thin Small Outline Package Type II (51-85087)



51-85087 *D

Package Diagrams (continued)

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



51-85150 *G

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} +2 V to V _{CC} +1 V 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 .
*G	3421856	10/25/2011	TAVA	Template Update Updated Features, Selection Guide, Operating Range, DC Electrical Characteristics Over the Operating Range, Switching Characteristics Over the Operating Range^[5], Data Retention Characteristics Over the Operating Range, Switching Waveforms, and Ordering Information Updated Package Diagrams

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