



64K x 16 Static RAM

Features

- 3.3V operation (3.0V–3.6V)
- High speed
 - $t_{AA} = 12 \text{ ns}$
- CMOS for optimum speed/power
- Automatic power-down when deselected
- Independent control of upper and lower bits
- Available in 400-mil SOJ

Functional Description

The WCFS1016V1C 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

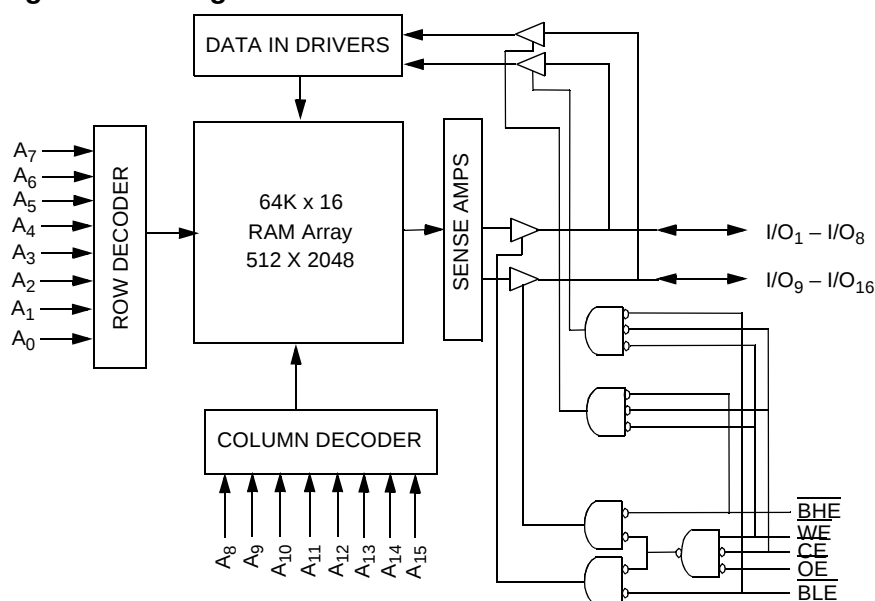
through A_{15}). If Byte High Enable ($\overline{BHE}$) is LOW, then data from I/O pins (I/O_9 through I/O_{16}) is written into the location specified on the address pins (A_0 through A_{15}).

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.

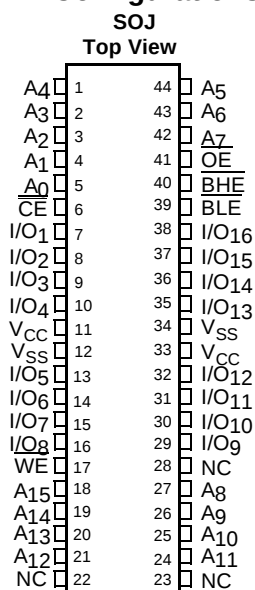
The input/output pins (I/O_1 through I/O_{16}) are placed in a high-impedance state when the device is deselected ($\overline{CE}$ HIGH), the outputs are disabled ($\overline{OE}$ HIGH), the $\overline{BHE}$ and $\overline{BLE}$ are disabled ($\overline{BHE}$, $\overline{BLE}$ HIGH), or during a write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

The WCFS1016V1C is available in 400-mil-wide SOJ packages.

Logic Block Diagram



Pin Configurations



Selection Guide

	WCFS1016V1C-12
Maximum Access Time (ns)	12
Maximum Operating Current (mA)	150
Maximum CMOS Standby Current (mA)	5

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 $V_{CC}+0.5V$

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%

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	WCFS1016V1C 12ns		Unit
			Min.	Max.	
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}, I_{OH} = -4.0 \text{ mA}$	2.4		V
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min.}, I_{OL} = 8.0 \text{ mA}$		0.4	V
V_{IH}	Input HIGH Voltage		2.2	$V_{CC} + 0.3V$	V
V_{IL}	Input LOW Voltage ^[1]		-0.3	0.8	V
I_{IX}	Input Load Current	$GND \leq V_I \leq V_{CC}$	-1	+1	μA
I_{OZ}	Output Leakage Current	$GND \leq V_I \leq V_{CC},$ Output Disabled	-1	+1	μA
I_{CC}	V_{CC} Operating Supply Current	$V_{CC} = \text{Max.},$ $I_{OUT} = 0 \text{ mA},$ $f = f_{MAX} = 1/t_{RC}$		150	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	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	mA

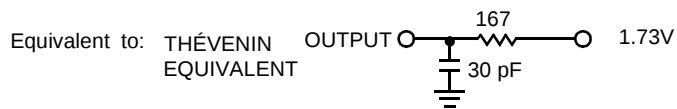
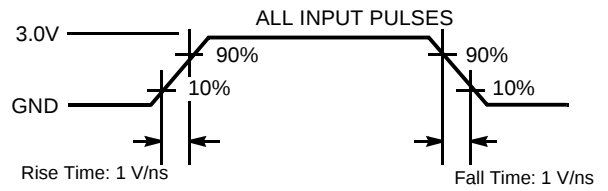
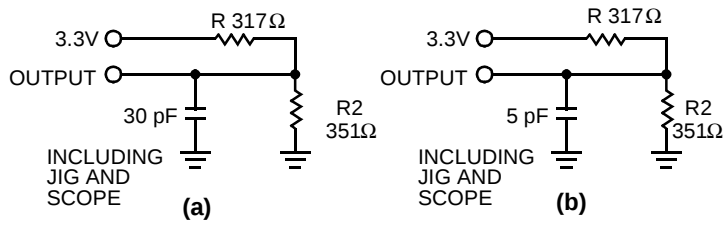
Capacitance^[3]

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:

- V_{IL} (min.) = -2.0V for pulse durations of less than 20 ns.
- T_A is the "instant on" case temperature.
- Tested initially and after any design or process changes that may affect these parameters.

AC Test Loads and Waveforms



Switching Characteristics^[4] Over the Operating Range

Parameter	Description	WCFS1016V1C 12ns		Unit
		Min.	Max.	
READ CYCLE				
t _{RC}	Read Cycle Time	12		ns
t _{AA}	Address to Data Valid		12	ns
t _{OHA}	Data Hold from Address Change	3		ns
t _{ACE}	$\overline{CE}$ LOW to Data Valid		12	ns
t _{DOE}	$\overline{OE}$ LOW to Data Valid		6	ns
t _{LZOE}	$\overline{OE}$ LOW to Low Z	0		ns
t _{HZOE}	$\overline{OE}$ HIGH to High Z ^[5, 6]		6	ns
t _{LZCE}	$\overline{CE}$ LOW to Low Z ^[6]	3		ns
t _{HZCE}	$\overline{CE}$ HIGH to High Z ^[5, 6]		6	ns
t _{PU}	$\overline{CE}$ LOW to Power-Up	0		ns
t _{PD}	$\overline{CE}$ HIGH to Power-Down		12	ns
t _{DBE}	Byte Enable to Data Valid		6	ns
t _{LZBE}	Byte Enable to Low Z	0		ns
t _{HZBE}	Byte Disable to High Z		6	ns
WRITE CYCLE ^[7]				
t _{WC}	Write Cycle Time	12		ns
t _{SCE}	$\overline{CE}$ LOW to Write End	9		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	8		ns
t _{SD}	Data Set-Up to Write End	6		ns
t _{HD}	Data Hold from Write End	0		ns
t _{LZWE}	$\overline{WE}$ HIGH to Low Z ^[6]	3		ns
t _{HZWE}	$\overline{WE}$ LOW to High Z ^[5, 6]		6	ns
t _{BW}	Byte Enable to End of Write	8		ns

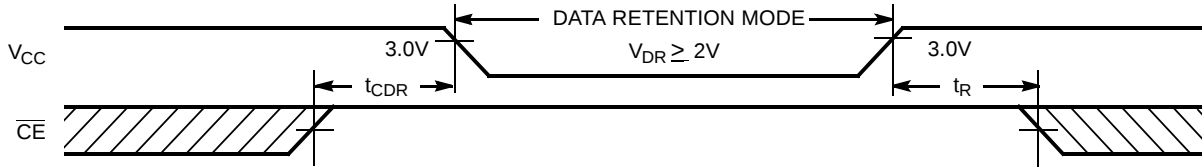
Data Retention Characteristics Over the Operating Range

Parameter	Description	Conditions ^[8]	Min.	Max.	Unit
V_{DR}	V_{CC} for Data Retention		2.0		V
t_{CDR} ^[9]	Chip Deselect to Data Retention Time	$V_{CC} = V_{DR} = 2.0V$, $CE \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$	0		ns
t_R ^[10]	Operation Recovery Time		t_{RC}		ns

Notes:

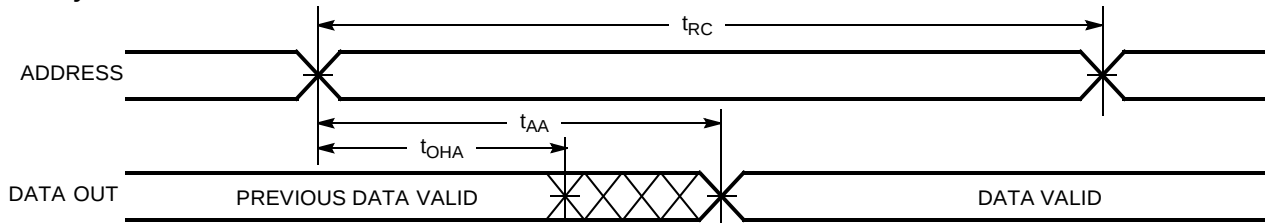
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- t_{HZOE} , t_{HZBE} , t_{HZCE} , and t_{HZWE} are specified with a load capacitance of 5 pF 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 $\overline{CE}$ 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.
- No input may exceed $V_{CC} + 0.5V$.
- Tested initially and after any design or process changes that may affect these parameters.
- $t_r \leq 3$ ns for the -12 and -15 speeds. $t_r \leq 5$ ns for the -20 and slower speeds.

Data Retention Waveform

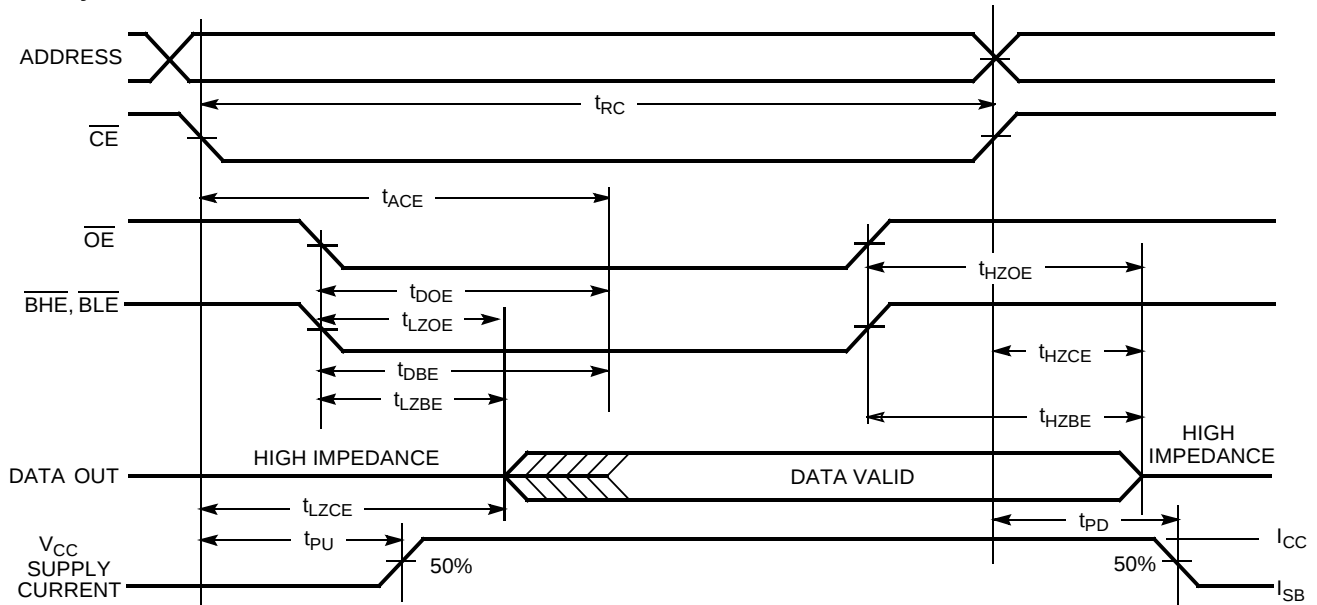


Switching Waveforms

Read Cycle No. 1^[11, 12]



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

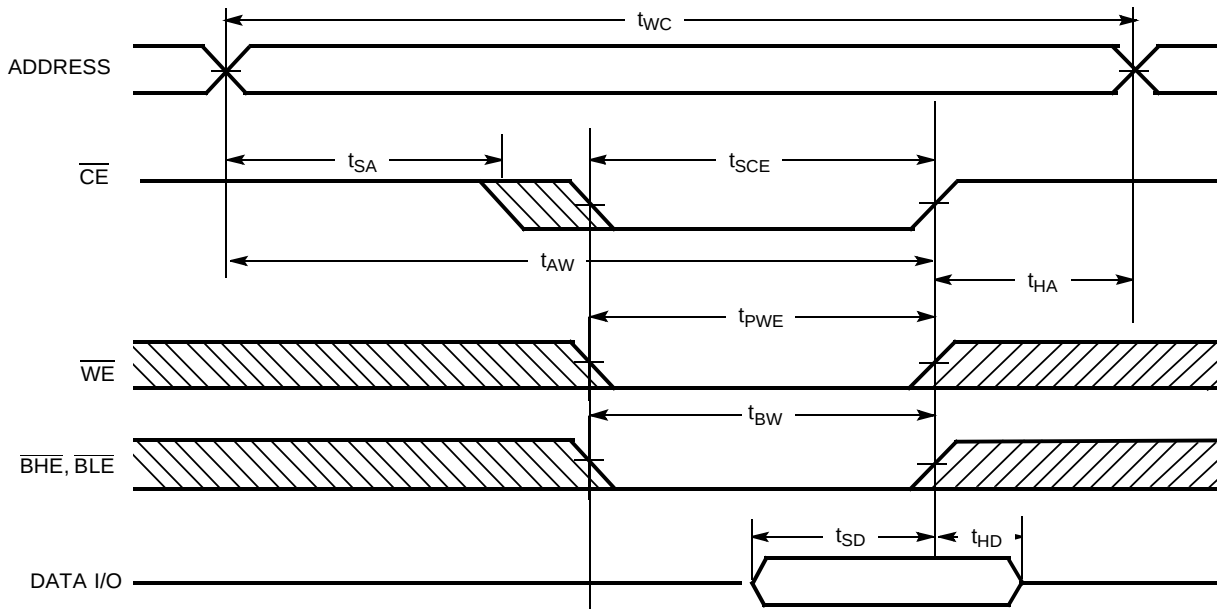


Notes:

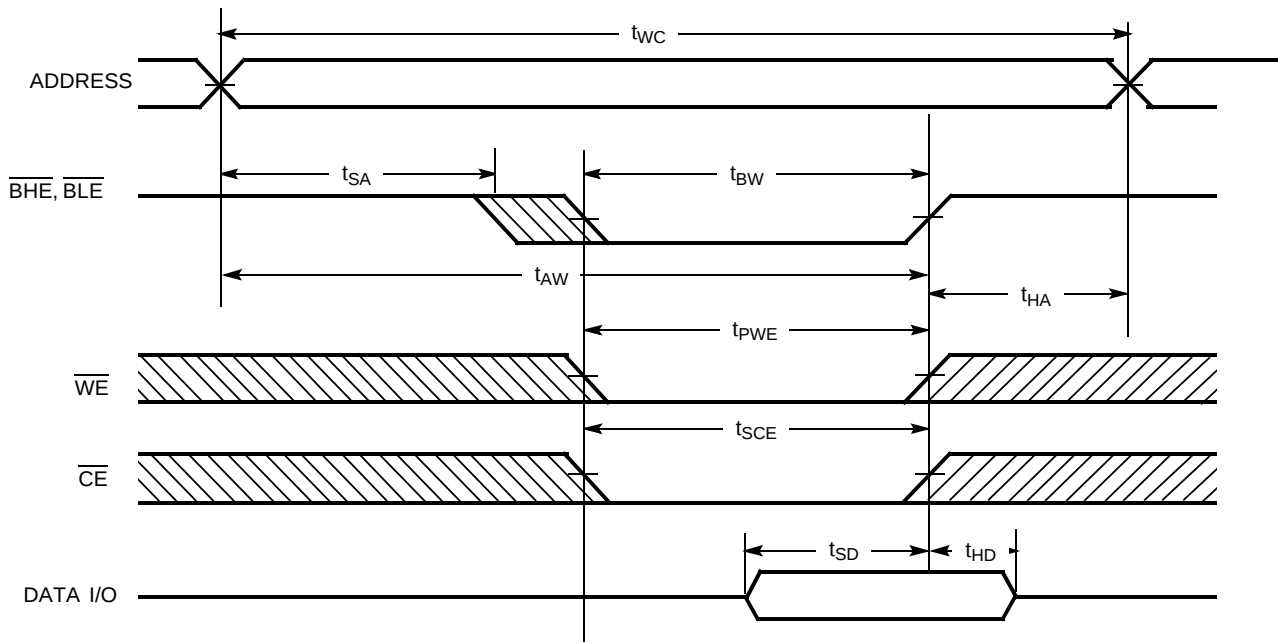
11. Device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{BHE}$ and/or $\overline{BLE}$ = V_{IL} .
12. $\overline{WE}$ is HIGH for read cycle.
13. Address valid prior to or coincident with $\overline{CE}$ transition LOW.

Switching Waveforms (continued)

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



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

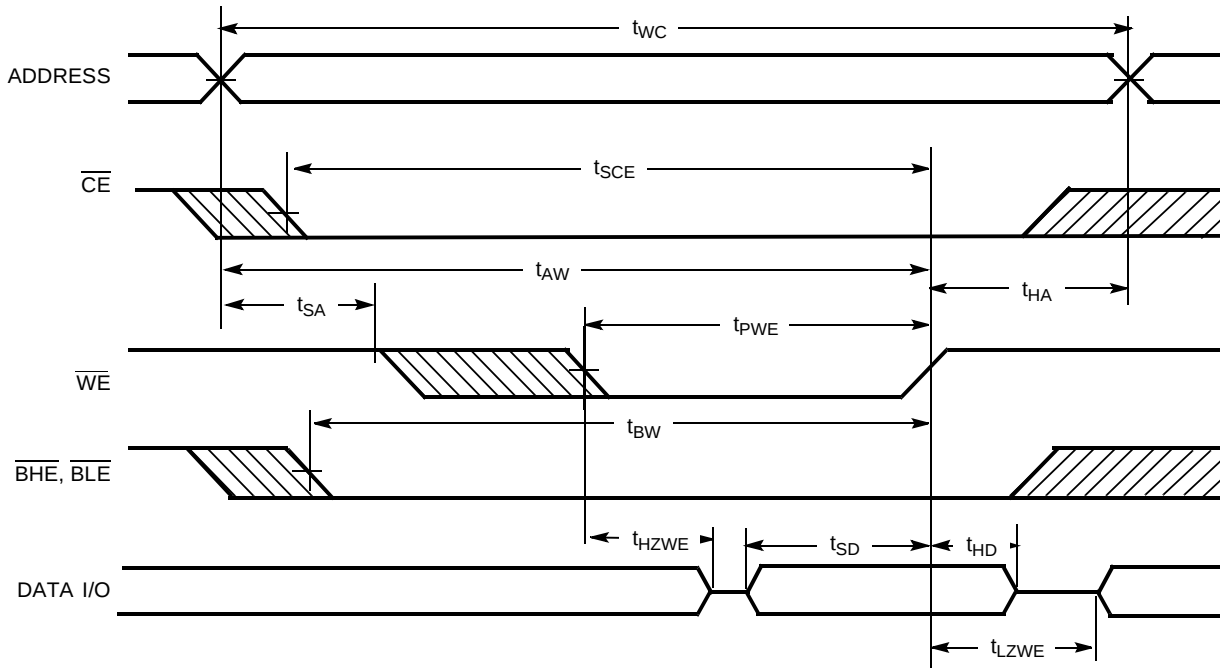


Notes:

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 ($\overline{\text{WE}}$ Controlled, LOW)



Truth Table

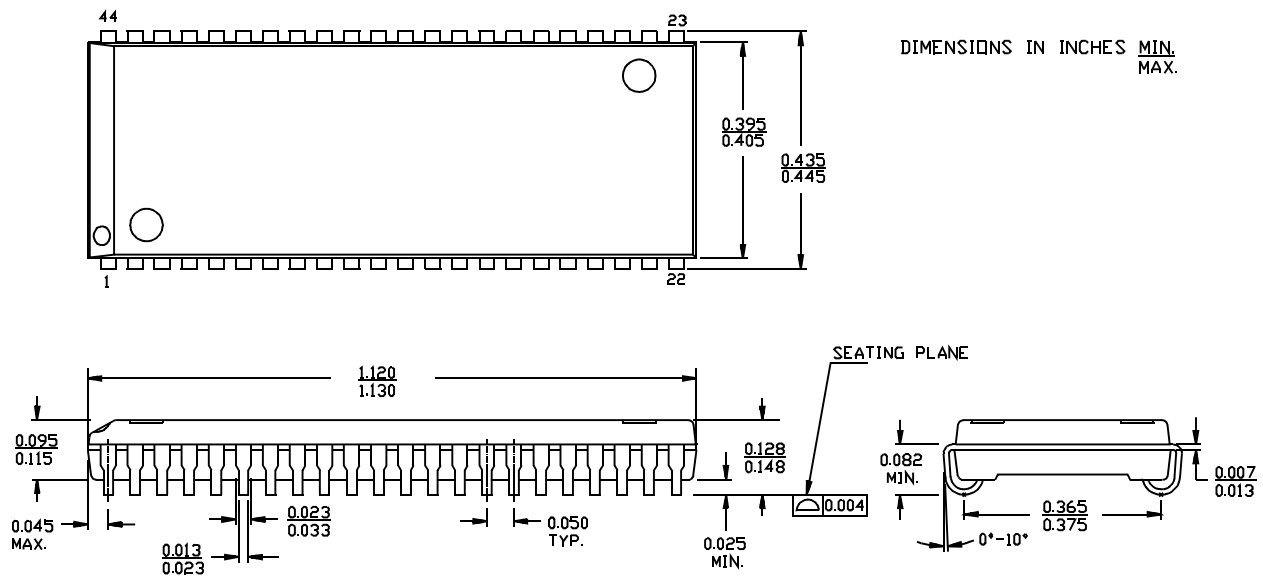
CE	OE	WE	BLE	BHE	I/O ₁ –I/O ₈	I/O ₉ –I/O ₁₆	Mode	Power
H	X	X	X	X	High Z	High Z	Power-Down	Standby (I_{SB})
L	L	H	L	L	Data Out	Data Out	Read - All bits	Active (I_{CC})
			L	H	Data Out	High Z	Read - Lower bits only	Active (I_{CC})
			H	L	High Z	Data Out	Read - Upper bits only	Active (I_{CC})
L	X	L	L	L	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
12	WCFS1016V1C-JC12	J	44-Lead (400-Mil) Molded SOJ	Commercial

Package Diagrams

44-Lead (400-Mil) Molded SOJ J





Document Title: WCFS1016V1C 64K x 16 Static RAM			
REV.	Issue Date	Orig. of Change	Description of Change
**	4/19/02	XFL	NEW DATASHEET

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9