



TABLE 1. PINOUT DESCRIPTION

PIN	SYMBOL	DESCRIPTION
34-28, 42-36, 62-64, 7, 8	A0-A18	Address Enable
65	$\overline{WE}$	WriteEnable
66	$\overline{OE}$	Output Enable
3-6	$\overline{CS1} - \overline{CS4}$	Chip Enable
43-46, 48-56, 58-61, 9-12, 14-17, 19-22, 24-27	I/O0-I/O31	Data Input/Output
2, 67, 68	NC	No Connection
1, 18, 35, 52	V <sub>CC</sub>	+5V Power Supply
13, 23, 47, 57	V <sub>SS</sub>	Ground

TABLE 2. 89C1632 ABSOLUTE MAXIMUM RATINGS

(VOLTAGE REFERENCED TO V<sub>SS</sub> = 0V)

PARAMETER	SYMBOL	MIN	MAX	UNITS
Power Supply Voltage Relative to V <sub>SS</sub>	V <sub>CC</sub>	-0.5	+7.0	V
Voltage Relative to V <sub>SS</sub> for Any Pin Except V <sub>CC</sub>	V <sub>IN</sub> , V <sub>OUT</sub>	-0.5	V <sub>CC</sub> +0.5	V
Power Dissipation	P <sub>D</sub>	--	4.0	W
Operating Temperature	T <sub>A</sub>	-55	+125	°C
Storage Temperature	T <sub>S</sub>	-65	+150	°C

TABLE 3. 89C1632 RECOMMENDED OPERATING CONDITIONS

(V<sub>CC</sub> = 5.0 ± 10%, T<sub>A</sub> = -55 TO +125 °C, UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	MIN	MAX	UNITS
Supply Voltage, (Operating Voltage Range)	V <sub>CC</sub>	4.5	5.5	V
Input High Voltage	V <sub>IH</sub>	2.2	V <sub>CC</sub> + 0.5 <sup>(1)</sup>	V
Input Low Voltage	V <sub>IL</sub>	-0.5 <sup>(2)</sup>	0.8	V

1. V<sub>IH</sub> (max) = V<sub>CC</sub> + 2V ac (pulse width ≤ 10ns) for I ≤ 80 mA.

2. V<sub>IL</sub> (min) = -2.0V ac; (pulse width ≤ 20 ns) for I ≤ 80 mA.

TABLE 4. 89C1632 CAPACITANCE  
(f = 1.0 MHz, dV = 3.0V, T<sub>A</sub> = 25 °C)

PARAMETER	SYMBOL	TEST CONDITIONS	MAX	UNITS
Input Capacitance <sup>1</sup> CS1 - CS4, OE, WE I/O0-7, I/O8-15, I/O16-23, I/O24-31	C <sub>IN</sub>	V <sub>IN</sub> = 0 V	7 28 7	pF
Input / Output Capacitance <sup>1</sup>	C <sub>OUT</sub>	V <sub>I/O</sub> = 0 V	8	pF

1. Guaranteed by design.

TABLE 5. 89C1632 DC ELECTRICAL CHARACTERISTICS  
(V<sub>CC</sub> = 5.0 ± 10%, T<sub>A</sub> = -55 TO +125 °C, UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input Leakage Current	I <sub>LI</sub>	V <sub>IN</sub> = 0 to V <sub>CC</sub>	-8.0	--	+8.0	uA
Output Leakage Current	I <sub>LO</sub>	$\overline{CS} = V_{IH}$ , V <sub>OUT</sub> = V <sub>SS</sub> to V <sub>CC</sub>	-8.0	--	+8.0	uA
Average Operating Current Cycle Time: 20 ns 25 ns 30 ns	I <sub>CC</sub>	Min. Cycle, 100% Duty, $\overline{CS} = V_{IL}$ , I <sub>OUT</sub> = 0 mA V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	--	--	800 760 720	mA
Standby Power Supply Current	I <sub>SB</sub>	$\overline{CS} = V_{IH}$ , cycle time ≥ 25ns	--	--	240	mA
CMOS Standby Power Supply Current	I <sub>SB1</sub>	$\overline{CS} \geq V_{CC} - 0.2V$ , f = 0 MHz, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2V or V <sub>IN</sub> < 0.2V	--	--	60	mA
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = + 8.0 mA	--	--	0.4	V
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -4.0 mA	2.4	--	--	V

TABLE 6. 89C1632 AC OPERATING CONDITIONS AND CHARACTERISTICS  
(V<sub>CC</sub> = 5.0 ± 10%, T<sub>A</sub> = -55 TO +125 °C, UNLESS OTHERWISE NOTED)

PARAMETER	MIN	TYP	MAX	UNITS
Input Pulse Level	0.0	--	3.0	V
Output Timing Measurement Reference Level	--	--	1.5	V
Input Rise/Fall Time	--	--	3.0	ns
Input Timing Measurement Reference Level	--	--	1.5	V

TABLE 7. 89C1632 READ CYCLE  
 ( $V_{CC} = 5.0 \pm 10\%$ ,  $T_A = -55$  TO  $+125$  °C, UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Read Cycle Time	$t_{RC}$				ns
-20		20	--	--	
-25		25	--	--	
-30		30	--	--	
Address Access Time	$t_{AA}$				ns
-20		--	--	20	
-25		--	--	25	
-30		--	--	30	
Chip Select to Output	$t_{CO}$				ns
-20		--	--	20	
-25		--	--	25	
-30		--	--	30	
Output Enable to Output	$t_{OE}$				ns
-20		--	--	10	
-25		--	--	12	
-30		--	--	14	
Output Enable to Low-Z Output	$t_{OLZ}$				ns
-20		--	0	--	
-25		--	0	--	
-30		--	0	--	
Chip Enable to Low-Z Output	$t_{LZ}$				ns
-20		--	3	--	
-25		--	3	--	
-30		--	3	--	
Output Disable to High-Z Output	$t_{OHZ}$				ns
-20		--	5	--	
-25		--	6	--	
-30		--	8	--	
Chip Disable to High-Z Output	$t_{HZ}$				ns
-20		--	5	--	
-25		--	6	--	
-30		--	8	--	
Output Hold from Address Change	$t_{OH}$				ns
-20		3	--	--	
-25		3	--	--	
-30		3	--	--	

TABLE 8. 89C1632 FUNCTIONAL DESCRIPTION

$\overline{CS}$	$\overline{WE}$	$\overline{OE}$	MODE	I/O PIN	SUPPLY CURRENT
H	X <sup>1</sup>	X <sup>1</sup>	Not Select	High-Z	$I_{SB}$ , $I_{SB1}$

TABLE 8. 89C1632 FUNCTIONAL DESCRIPTION

$\overline{\text{CS}}$	$\overline{\text{WE}}$	$\overline{\text{OE}}$	MODE	I/O PIN	SUPPLY CURRENT
L	H	H	Output Disable	High-Z	$I_{\text{CC}}$
L	H	L	Read	$D_{\text{OUT}}$	$I_{\text{CC}}$
L	L	X <sup>1</sup>	Write	$D_{\text{IN}}$	$I_{\text{CC}}$

1. X = don't care.

TABLE 9. 89C1632 WRITE CYCLE  
( $V_{\text{CC}} = 5.0 \pm 10\%$ ,  $T_{\text{A}} = -55$  TO  $+125$  °C, UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Write Cycle Time	$t_{\text{WC}}$				ns
-20		20		--	
-25		25		--	
-30		30		--	
Chip Select to End of Write	$t_{\text{CW}}$				ns
-20		14		--	
-25		17		--	
-30		20		--	
Address Set-up Time	$t_{\text{AS}}$				ns
-20		0		--	
-25		0		--	
-30		0		--	
Address Valid to End of Write	$t_{\text{AW}}$				ns
-20		14		--	
-25		17		--	
-30		20		--	
Write Pulse Width ( $\overline{\text{OE}}$ High)	$t_{\text{WP}}$				ns
-20		14		--	
-25		17		--	
-30		20		--	
Write Pulse Width ( $\overline{\text{OE}}$ Low)	$t_{\text{WP1}}$				ns
-20		20		--	
-25		25		--	
-30		30		--	
Write Recovery Time	$t_{\text{WR}}$				ns
-20		0		--	
-25		0		--	
-30		0		--	
Write to Output High-Z	$t_{\text{WHZ}}$				ns
-20		--	5	--	
-25		--	7	--	
-30		--	9	--	

TABLE 9. 89C1632 WRITE CYCLE  
 ( $V_{CC} = 5.0 \pm 10\%$ ,  $T_A = -55$  TO  $+125$  °C, UNLESS OTHERWISE NOTED)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Data to Write Time Overlap -25 -30	$t_{DW}$	10 12 14		-- -- --	ns
Data Hold from Write Time -20 -25 -30	$t_{DH}$	0 0 0		-- -- --	ns
End Write to Output Low-Z -20 -25 -30	$t_{OW}$	-- -- --	3 3 3	-- -- --	ns

FIGURE 1. AC TEST LOADS

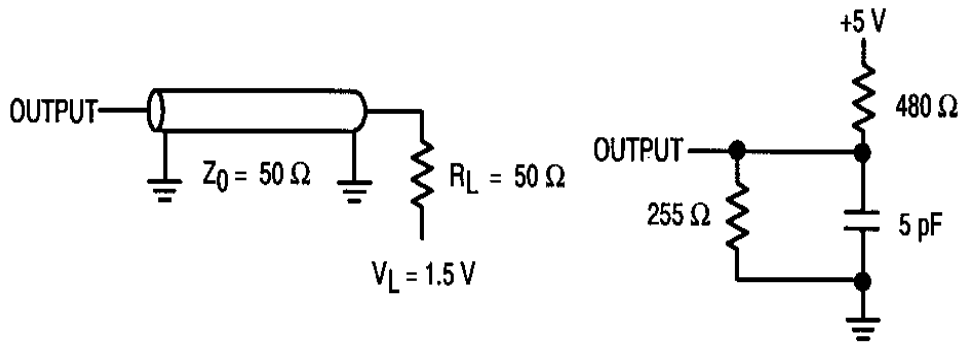


Figure 1A

Figure 1B

FIGURE 2. TIMING WAVEFORM OF READ CYCLE (1) (ADDRESS CONTROLLED)

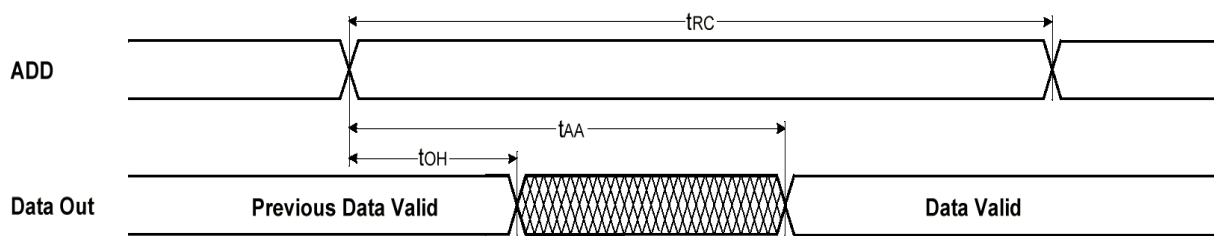
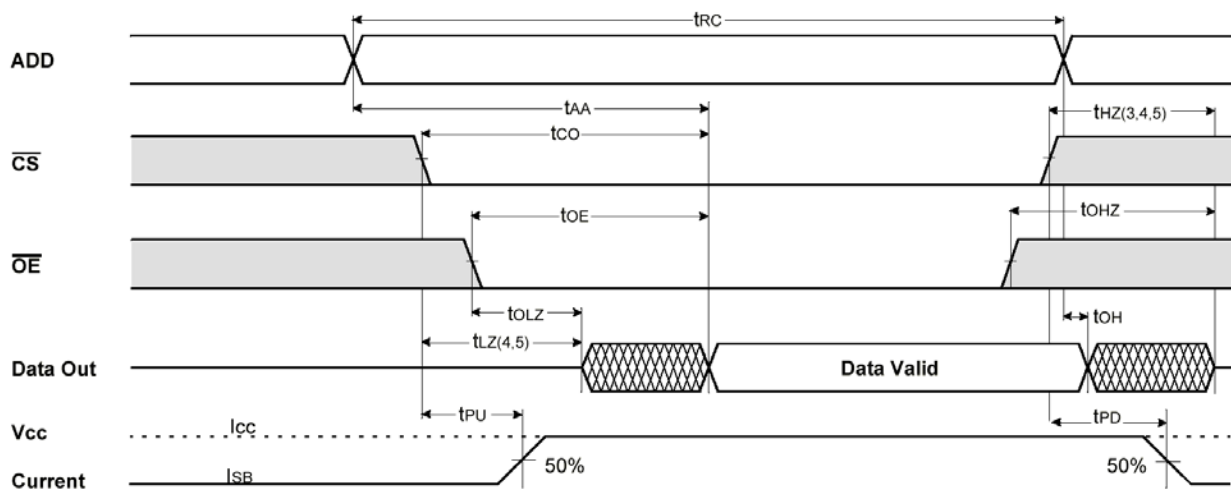


FIGURE 3. TIMING WAVEFORM OF READ CYCLE (2) ( $\overline{WE} = V_{IH}$ )



1.  $\overline{WE}$  is high for read cycle.
2. All read cycle timing is referenced from the last valid address to the first transition address.

3.  $t_{HZ}$  and  $t_{OHZ}$  are defined as the time at which the outputs achieve the open circuit condition and are not referenced to  $V_{OH}$  or  $V_{OL}$  levels.
4. At any given temperature and voltage conditions,  $t_{HZ}$  (max) is less than  $t_{LZ}$  (min) both for a given device and from device to device.
5. Transition is measured  $\pm 200\text{mV}$  from steady state voltage with Load(B). This parameter is sampled and not 100% tested.
6. Device is continuously selected with  $\overline{CS} = V_{IL}$ .
7. Address valid prior to coincident with  $\overline{CS}$  transition low.
8. For common I/O applications, minimization or elimination of bus contention conditions is necessary during read and write cycle.

FIGURE 4. TIMING WAVEFORM OF WRITE CYCLE (1) ( $\overline{OE}$  CLOCK)

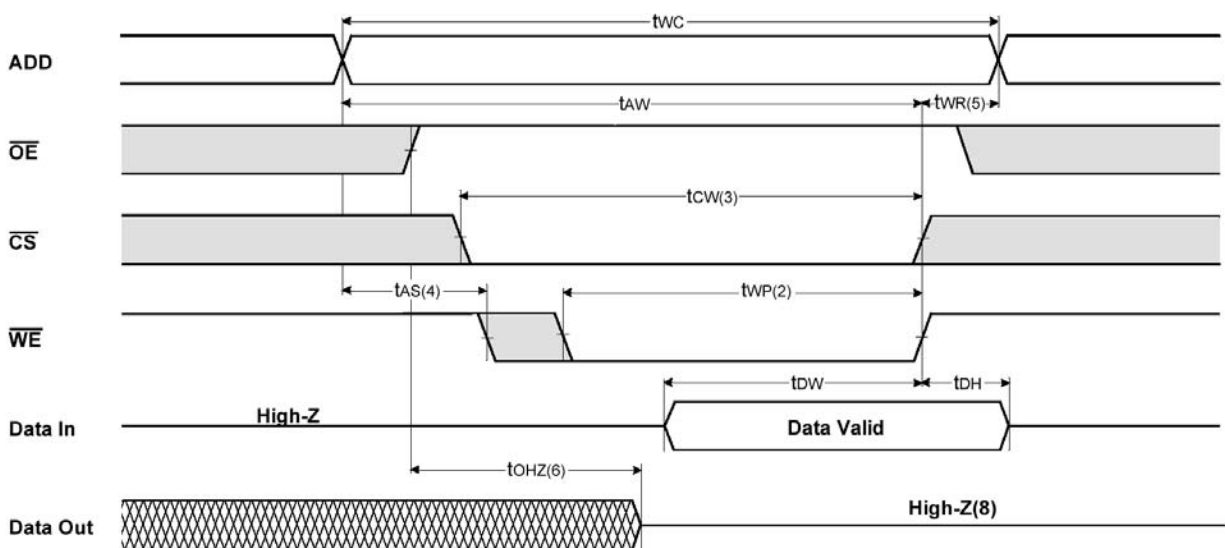


FIGURE 5. TIMING WAVEFORM OF WRITE CYCLE (2) ( $\overline{OE}$  LOW FIXED)

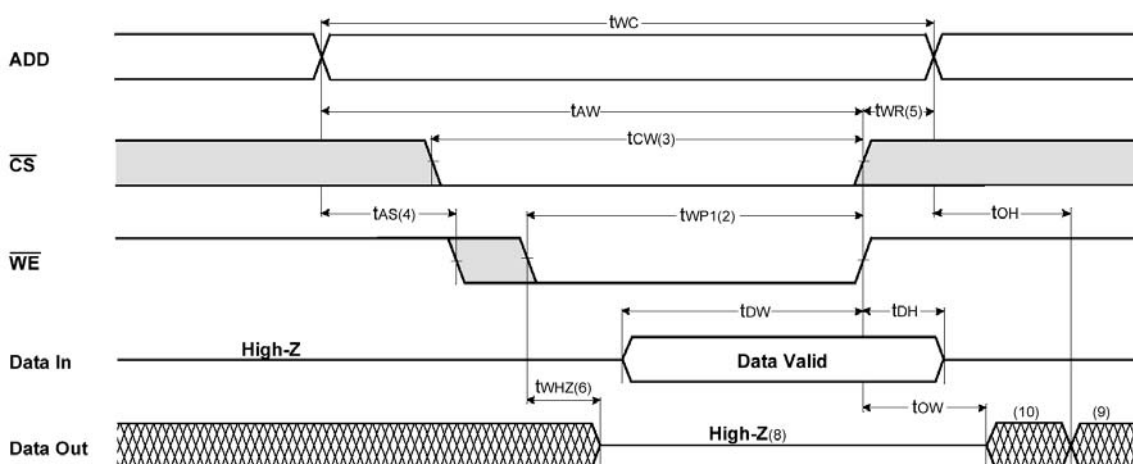
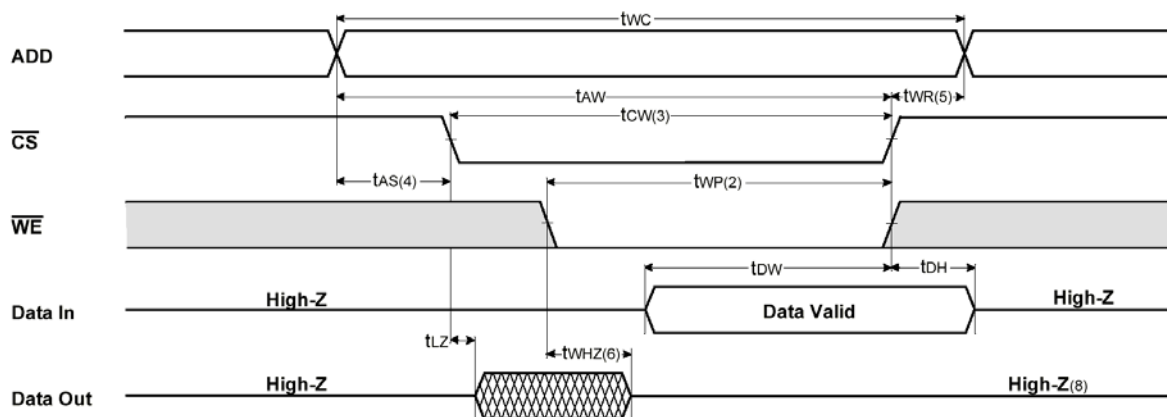




FIGURE 6. TIMING WAVEFORM OF WRITE CYCLE <sup>(3)</sup> ( $\overline{\text{CS}}$  CONTROLLED)

1. All write cycle timing is referenced from the last valid address to the first transition address.
2. A write occurs during the overlap of a low  $\overline{\text{CS}}$  and  $\overline{\text{WE}}$ . A write begins at the latest transition  $\overline{\text{CS}}$  going low and  $\overline{\text{WE}}$  going low. A write ends at the earliest transition  $\overline{\text{CS}}$  going high or  $\overline{\text{WE}}$  going high.  $t_{WP}$  is measured from the beginning of write to the end of write.
3.  $t_{CW}$  is measured from the later of  $\overline{\text{CS}}$  going low to end of write.
4.  $t_{AS}$  is measured from the address valid to the beginning of write.
5.  $t_{WR}$  is measured from the end of write to the address change.  $t_{WR}$  applied in case a write ends as  $\overline{\text{CS}}$  or  $\overline{\text{WE}}$  going high.
6. If  $\overline{\text{OE}}$ ,  $\overline{\text{CS}}$  and  $\overline{\text{WE}}$  are in the Read Mode during this period, the I/O pins are in the output low-Z state. Inputs of opposite phase of the output must not be applied because bus contention can occur.
7. For common I/O applications, minimization of elimination of bus contention conditions is necessary during read and write cycle.
8. If  $\overline{\text{CS}}$  goes low simultaneously with  $\overline{\text{WE}}$  going or after  $\overline{\text{WE}}$  going low, the outputs remain high impedance state.
9.  $D_{OUT}$  is the read data of the new address.
10. When  $\overline{\text{CS}}$  is low, I/O pins are in the output state. The input signals in the opposite phase leading to the output should not be applied.

FIGURE 7. SRAM HEAVY ION CROSS SECTION

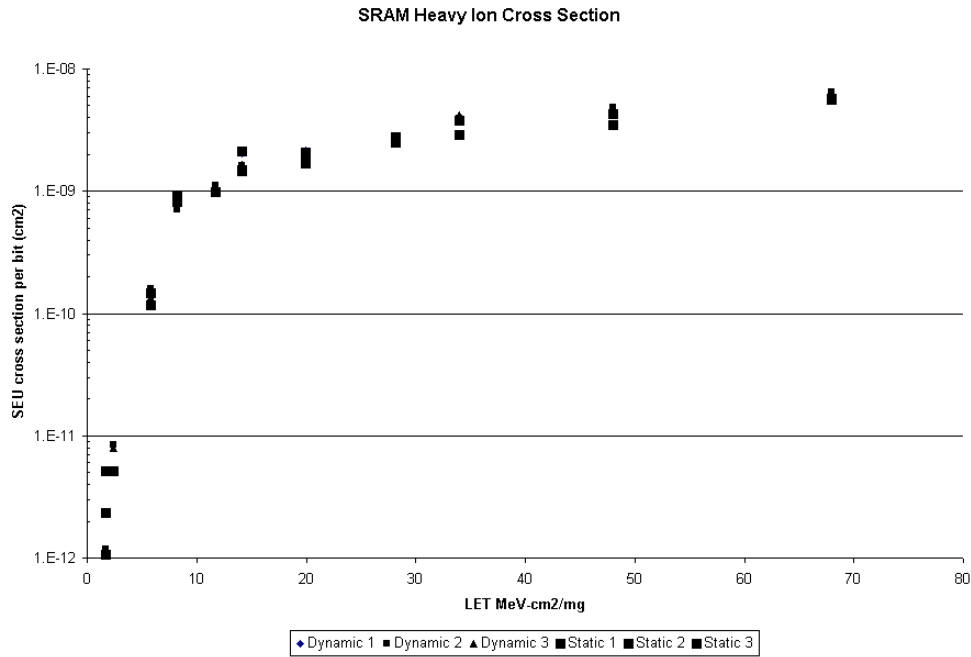
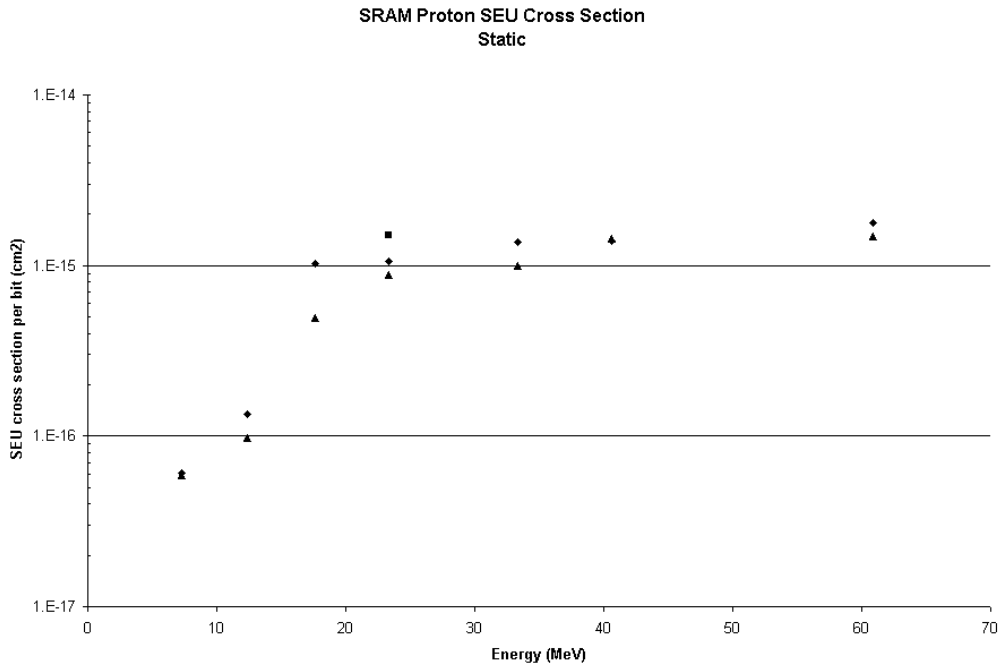
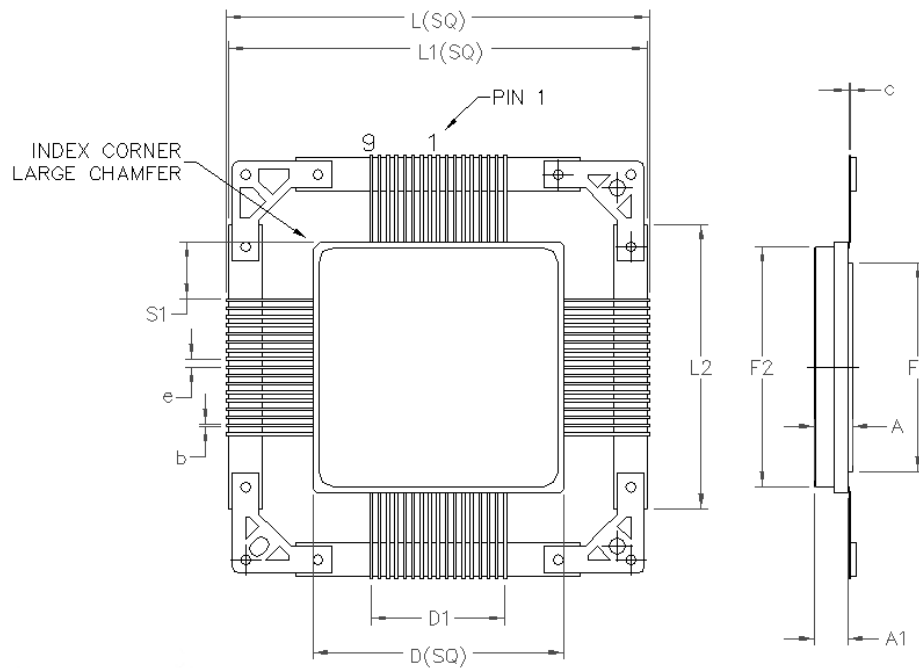


FIGURE 8. SRAM PROTON SEU CROSS SECTION STATIC





## 68 PIN RAD-PAK® QUAD FLAT PACKAGE

SYMBOL	DIMENSION		
	MIN	NOM	MAX
A	0.206	0.225	0.244
b	0.015	0.017	0.018
c	0.008	0.009	0.12
D	1.479	1.494	1.509
D1	0.800		
e	0.050 BSC		
S1	--	0.339	--
F1	1.239	1.244	1.249
F2	1.429	1.434	1.439
L	2.485	2.510	2.545
L1	2.485	2.500	2.505
L2	1.690	1.700	1.710
A1	0.180	0.195	0.210
N	68		

Q68-04

Note: All dimensions in inches

## Important Notice:

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# 16 Megabit (512K x 32-Bit) MCM SRAM

# 89C1632

## Product Ordering Options

