

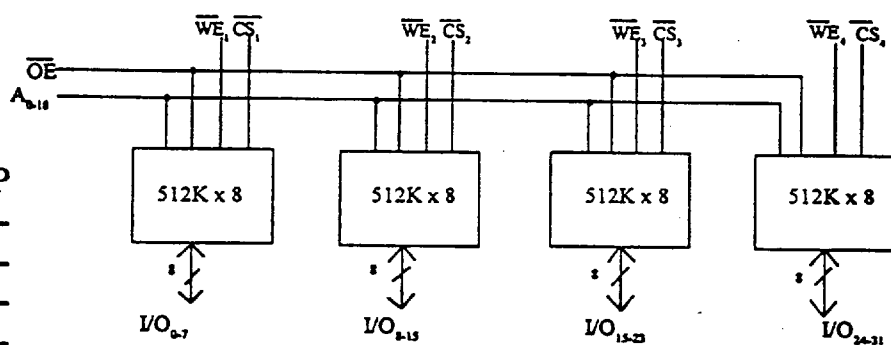
16 Megabit SRAM - Radiation Hardened 89C016PRP

4 x (512 kword x 8 bit)
MCM Memory

*For Space
Applications*

SEI's 89C016PRP (RP for RAD-PAK®) multi-chip module (MCM) features a minimum 100 kilorad (Si) total dose tolerance. Using SEI's radiation hardened RAD-

PAK® MCM packaging technology, the 89C016PRP is fully equivalent to the commercial Hitachi HM628512 which is a 512k x 8 SRAM. The 89C016PRP uses four 4 Megabit Hitachi's high speed CMOS die to yield a 16 Megabit product. It realizes higher density, higher performance, and low power consumption by employing 0.5 micron Hi-CMOS process technology. Capable of surviving space environments, the 89C016PRP is ideal for satellite, spacecraft, and space probe missions. The 89C016PRP features the same advanced 512k x 8 SRAM, high speed, and low power demand as the SEI's 32C408RP, and the MCM technology substantially reduces printed board space and capacitance. The patented radiation hardened RAD-PAK® MCM technology incorporates radiation shielding in the microcircuit package. It eliminates box shielding while providing lifetime in orbit. This product is available in Class B and S packaging and screening.



MCM Architecture



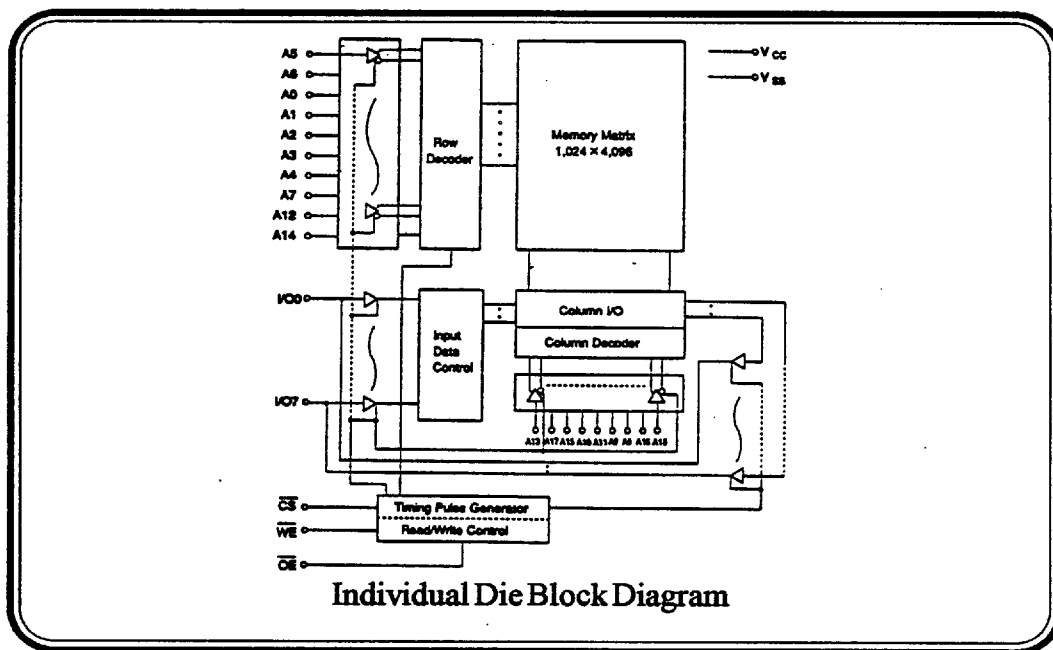
**SPACE
ELECTRONICS
INCORPORATED**

Tel: (619) 452-4167 Fax: (619) 452-5499

89C016PRP RAD HARD 4 x (512k x 8) MCM MICROCIRCUIT

Radiation Hardened 89C016PRP

CMOS 68 Pin
Multi-Chip Module Memory



Features

- ▲ Four 524,288 word x 8 bit MCM Organization
- ▲ RAD-PAK® Radiation Hardened Against Natural Space Radiation
- ▲ Total Dose Hardness >100 krad (Si)
- ▲ Package:
 - 68 Pin RAD-PAK® quad flat pack (950 mils x 950 mils)
 - Weight - 12.0 grams
- ▲ Fast Propagation Time:
 - 65, 70, 85 ns Maximum Times Available
- ▲ Completely Static Memory
 - No clock or timing strobe required
- ▲ High Speed 0.5 micron CMOS Technology
 - Single 5 Volt power supply
 - Equal access and cycle times
 - Three state output, TTL compatible
 - Low power:
 - Standby: 40 uW typical
 - Operation: 300mW/MHz typical
 - Capability of battery backup operation
- ▲ Screening in accordance with MIL-PRF-83534
- ▲ QCI in accordance with MIL-PRF-83534

Specifications and design are subject to change without notice.



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For Further Information Contact:

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89C016PRP ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage	V_{CC}	4.5	5.5	V
Voltage on Any Pin, Relative to V_{SS}	V_T	-0.5	$V_{CC} + 0.5$	V
Power Dissipation	P_D		1.0	W
Storage Temperature	T_s	-65	+150	°C
Operating Temperature	T_A	-55	+125	°C

89C016PRP RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage, Positive	V_{CC}	4.5	5.5	V
Supply Voltage, Negative	V_{SS}	0	0	V
Input High Voltage	V_{IH}	2.2	6.0	V
Input Low Voltage	V_{IL}	-0.3	0.8	V



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89C016PRP DC ELECTRICAL CHARACTERISTICS 1/

PARAMETER	SYMBOL	MIN	MAX	UNIT
Input Leakage Current ($V_{IN}=V_{SS}$ to V_{CC}) WE ₁₋₄ \ CS ₁₋₄ \ OE\ A ₀₋₁₈ \	I _{LI}		1 1 4 4	uA
Output Leakage Current (CS ₁ =V _{IH} or CS ₂ =V _{IL} or OE=V _{IH} or WE=V _{IL} , V _{IO} =V _{SS} to V _{CC}) WE ₁₋₄ \ CS ₁₋₄ \ OE\ A ₀₋₁₈ \	I _{LO}		1 1 4 4	uA
Output Low Voltage	V _{OL}		0.4	V
Output High Voltage	V _{OH}	2.4		V
Operating Supply Current:DC CS ₁ =V _{IL} , WE=V _{IH} , others=V _{IH} /V _{IL} , I _{IO} =0mA CS ₁ =V _{IH} , WE=V _{IL} , others=V _{IH} /V _{IL} , I _{IO} =0mA	I _{CCREAD} I _{CCWRITE}		100 180	mA
Operating Supply Current Min. cycle, duty=100%, CS ₁ =V _{IL} , others=V _{IH} /V _{IL} , I _{IO} =0mA	I _{CC1}		360	mA
Operating Supply Current Cycle time=1us, duty=100%, I _{IO} =0mA, CS ₁ ≤0.2V, CS ₂ ≥V _{CC} -0.2V, V _{IL} ≤0.2V	I _{CC2}		140	mA
Standby Supply Current:DC (CS ₁ =V _{IH})	I _{SB}		12	mA
Standby Power Supply Current,DC (V _{IN} ≥0V, CS ₁ ≥V _{CC} -0.2V) 1/	I _{SB1}		8	mA
Input Capacitance (f = 1MHz, V _{IN} =0V) WE ₁₋₄ \ CS ₁₋₄ \ OE\ A ₀₋₁₈ \	C _{in}		8 8 32 32	pF
Output Capacitance (f = 1MHz, V _{IO} =0V)	C _{IO}		10	pF

Notes:

- 1/ V_{CC} = 4.5V to 5.5 V; V_{SS} = 0V; T_A = -55 to +125°C.
- 2/ Guaranteed by design.



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89C016PRP AC ELECTRICAL CHARACTERISTICS - READ CYCLE

PARAMETER	SYMBOL	MIN	MAX	UNIT
Read Cycle Time 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85	t_{RC}	65 70 85		ns
Address Access Time 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85	t_{AA}		65 70 85	ns
Chip Selection Access Time 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85	t_{CO1}		65 70 85	ns
Output Enable (OE) Output Valid 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85	t_{OE}		30 35 45	ns
Chip Selection (CS1) to Output in Low-Z 89C016PRP - 65, 70, 85 2/ 3/ 4/	t_{LZ1}	10		ns
Output Enable (OE) to Output in Low-Z 89C016PRP - 65, 70, 85 2/ 3/ 4/	t_{OLZ}	5		ns
Chip Deselection (CS1) to Output in High-Z 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85 2/ 3/ 4/	t_{HZ1}	0 0 0	20 25 30	ns
Output Disable (OE) to Output in High-Z 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85 2/ 3/ 4/	t_{OHZ}	0 0 0	20 25 30	ns
Output Hold From Address Change 89C016PRP - 65, 70, 85	t_{OH}	10		ns

Notes:

1/ $V_{CC} = 4.5V$ to $5.5V$; $V_{SS} = 0V$; $T_A = -55$ to $+125^{\circ}C$.

2/ t_{HZ} and t_{OHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.

3/ At any given temperature and voltage condition, t_{HZ} max is less than t_{LZ} min for both a given device and from device to device.

4/ Guaranteed by design.



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89C016RP AC ELECTRICAL CHARACTERISTICS - WRITE CYCLE 1/

PARAMETER	SYMBOL	MIN	MAX	UNIT
Write Cycle Time 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85	t_{wc}	65 70 85		ns
Chip Selection to End of Write 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85	t_{cw}	55 60 75		ns
Address Setup Time 89C016PRP - 65, 70, 85	t_{AS}	0		ns
Address Valid to End of Write 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85	t_{AW}	55 60 75		ns
Write Pulse Width 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85	t_{WP}	45 50 55		ns
Write Recovery Time 89C016PRP - 65, 70, 85	t_{WR}	5		ns
WEA to Output in High-Z 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85	t_{WHZ}	0 0 0	20 25 30	ns
Data to Write Time Overlap 89C016PRP - 65 89C016PRP - 70 89C016PRP - 85	t_{DW}	25 30 35		ns
Output Active from End of Write 89C016PRP - 65, 70, 85	t_{OW}	5		ns
Data Hold from Write Time 89C016PRP - 65, 70, 85	t_{DH}	0		ns

Notes:

1/ $V_{CC} = 4.5V$ to $5.5V$; $V_{SS} = 0V$; $T_A = -55$ to $+125^{\circ}C$.



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89C016PRP PINOUT DESCRIPTION

PIN	SYMBOL	DESCRIPTION	PIN	SYMBOL	DESCRIPTION
1	GND	Ground	35	OE	Output Enable
2	CS ₃	Chip Select	36	CS ₂	Chip Select
3	A5	Address Input	37	A17	Address Input
4	A4	Address Input	38	WE ₂	Write Enable
5	A3	Address Input	39	WE ₃	Write Enable
6	A2	Address Input	40	WE ₄	Write Enable
7	A1	Address Input	41	A18	Address Input
8	A0	Address Input	42	GND	Ground
9	Vcc	Power Supply	43	GND	Ground
10	I/O ₀	Data Input/Output	44	I/O ₃₁	Data Input/Output
11	I/O ₁	Data Input/Output	45	I/O ₃₀	Data Input/Output
12	I/O ₂	Data Input/Output	46	I/O ₂₉	Data Input/Output
13	I/O ₃	Data Input/Output	47	I/O ₂₈	Data Input/Output
14	I/O ₄	Data Input/Output	48	I/O ₂₇	Data Input/Output
15	I/O ₅	Data Input/Output	49	I/O ₂₆	Data Input/Output
16	I/O ₆	Data Input/Output	50	I/O ₂₅	Data Input/Output
17	I/O ₇	Data Input/Output	51	I/O ₂₄	Data Input/Output
18	GND	Ground	52	GND	Ground
19	I/O ₈	Data Input/Output	53	I/O ₂₃	Data Input/Output
20	I/O ₉	Data Input/Output	54	I/O ₂₂	Data Input/Output
21	I/O ₁₀	Data Input/Output	55	I/O ₂₁	Data Input/Output
22	I/O ₁₁	Data Input/Output	56	I/O ₂₀	Data Input/Output
23	I/O ₁₂	Data Input/Output	57	I/O ₁₉	Data Input/Output
24	I/O ₁₃	Data Input/Output	58	I/O ₁₈	Data Input/Output
25	I/O ₁₄	Data Input/Output	59	I/O ₁₇	Data Input/Output
26	I/O ₁₅	Data Input/Output	60	I/O ₁₆	Data Input/Output
27	Vcc	Data Input/Output	61	Vcc	Power Supply
28	A11	Address Input	62	A10	Address Input
29	A12	Address Input	63	A9	Address Input
30	A13	Address Input	64	A8	Address Input
31	A14	Address Input	65	A7	Address Input
32	A15	Address Input	66	A6	Address Input
33	A16	Address Input	67	WE ₁	Write Enable
34	CS ₁	Chip Select	68	CS ₄	Chip Select



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89C016RP Package Ordering Guide

Package Style	Case Outline	1/	Description
Q	Q-68		68 Pin Quad Flat Package

Note:

1/ For outline information, see Appendix A (Package Information - Outline Dimension)



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