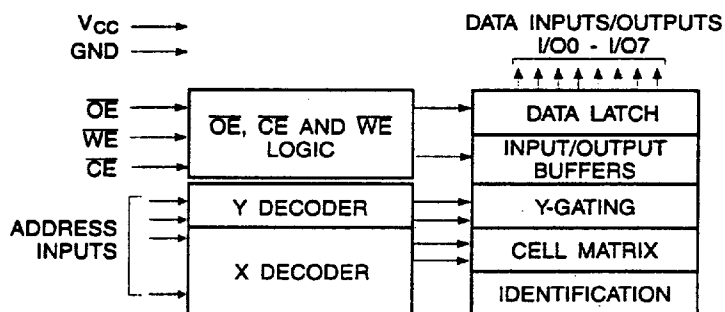


1 Megabit EEPROM - Radiation Hardened 28C010ERP

128k X 8 EEPROM
Memory Microcircuit

For Space Applications

SEI's 28C010ERP (RP for RAD-PAK®) high density 1 megabit EEPROM microcircuit features a minimum 100 kilorad (Si) total dose tolerance. Using SEI's radiation hardened RAD-PAK® packaging technology, the 28C010ERP is fully equivalent to AT28C010 from Atmel's advanced nonvolatile CMOS technology. The 28C010ERP can access the read or write cycle without the need for external components. The device contains a 128-byte page register to allow writing of up to 128 bytes simultaneously. During a write cycle, the address and 1 to 128 bytes of data are internally latched, freeing the address and data bus for other operations. Following the initiation of a write cycle, the device will automatically write the latched data using an internal control timer. The end of a write cycle can be detected by DATA polling of I/O7. Once the end of a write cycle has been detected a new access for a read or write can begin. The device also utilizes internal error correction for extended endurance and improved data retention characteristics. It includes an extra 128 bytes of EEPROM for device identification or tracking. The patented radiation hardened RAD-PAK® technology incorporates radiation shielding in the microcircuit package. Capable of surviving in space environments, the 28C010ERP is ideal for satellite, spacecraft, and space probe missions. The 28C010ERP is available in Class S packaging and screening.



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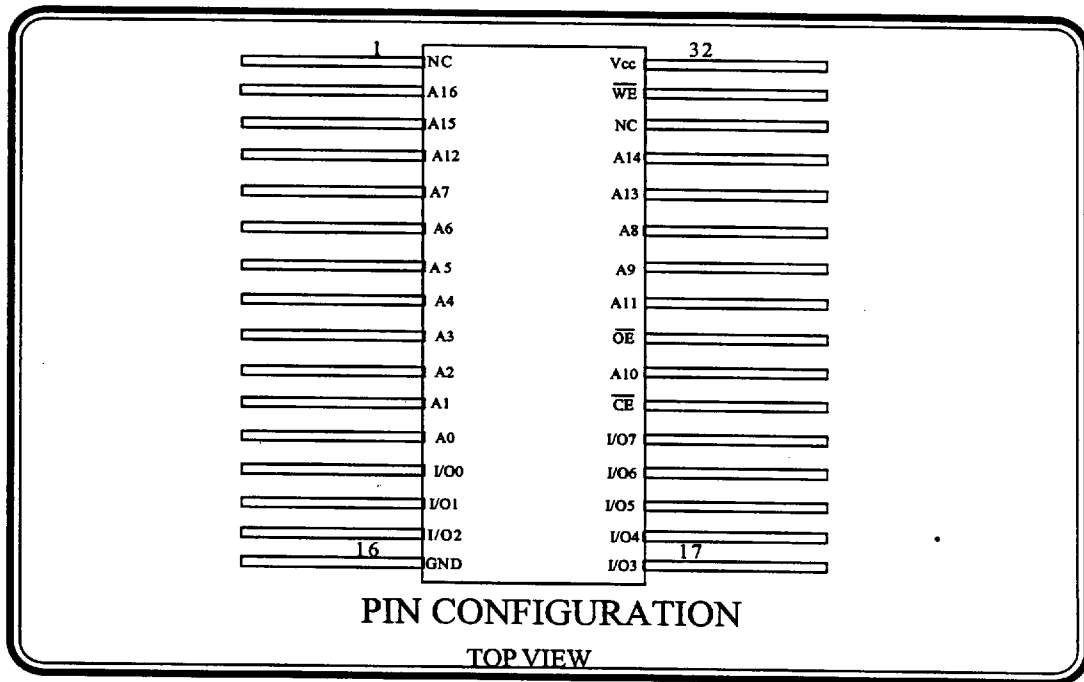
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SEI 28C010ERP RADHARD 128k x 8 EEPROM MICROCIRCUIT

Radiation Hardened 28C010ERP

CMOS 128kx8 EEPROM
Memory Microcircuit



Features:

- 128k x 8 Bit EEPROM Organization
- Pin Compatible with Atmel AT28C010
- RAD-PAK® Radiation Hardened
Against Natural Space Radiation
- Total Dose Hardness >100 krad (Si)
- Package:
 - 32 Pin RAD-PAK® flat pack
(410 mils x 820 mils)
 - Weight – 6.0 grams
- Fast Propagation Time:
 - 120, 250 ns Maximum Access
Times Available
- JEDEC Approved Byte Wide Pinout
- High Endurance
 - 10,000 Cycles/Byte
 - 10 Year Data Retention
- Page Write Mode
 - 1 to 128 Byte Page
- CMOS and TTL Compatible Inputs
and Outputs
- Low Power Consumption
 - 80 mA Active Current
 - 300 µA Standby Current

Specifications and design are subject to change without notice.



Sept. 1995

■ 9011241 0000010 378 ■

For Further Information Contact:

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28C010ERP ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Temperature Under Bias	T_{BIAS}	-55	+125	°C
Storage Temperature	T_S	-65	+150	°C
All Input Voltages (including N.C. Pins with Respect to Ground)	V_{IN}	-0.6	+6.25	V
All Output Voltages with Respect to Ground	V_{OUT}	-0.6	$V_{CC}+0.6$	V

28C010ERP OPERATING MODES

PARAMETER	SYMBOL	MIN	MAX	UNIT
Operating Temperature	T_{OPER}	-55	+125	°C
V_{CC} Power Supply	V_{CC}	4.75	5.25	V

28C010ERP OPERATING MODES

MODE	CE\	OE\	WE\	I/O
Read	V_{IL}	V_{IL}	V_{IH}	D_{OUT}
Write	V_{IL}	V_{IH}	V_{IL}	D_{IN}
Standby/Write Inhibit	V_{IH}	X ⁽¹⁾	X	High Z
Write Inhibit	X	X	V_{IH}	
Write Inhibit	X	V_{IL}	X	
Output Disable	X	V_{IH}	X	High Z

Note: 1. X can be V_L or V_{IH}



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28C010ERP DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN	MAX	UNITS
Input Load Current	I_{IL}	$V_{IN} = 0V$ to $V_{CC}+1V$		10	μA
Output Leakage Current	I_{LO}	$V_{IO} = 0V$ to V_{CC}		10	μA
V_{CC} Standby Current CMOS	I_{SB1}	$CE\backslash = V_{CC}-0.3V$ to $V_{CC}+1V$		300	μA
V_{CC} Standby Current TTL	I_{SB2}	$CE\backslash = 2.0V$ to $V_{CC}+1V$		3	mA
V_{CC} Active Current	I_{CC}	$f = 5MHz$; $I_{OUT} = 0mA$		80	mA
Input Low Voltage	V_{IL}			0.8	V
Input High Voltage	V_{IH}		2.0		V
Output Low Voltage	V_{OL}	$I_{OL} = 2.1 mA$.45	V
Output High Voltage	V_{OH1}	$I_{OH} = -400 \mu A$	2.4		V
Output High Voltage CMOS	V_{OH2}	$I_{OH} = -100 \mu A$; $V_{CC} = 4.5 V$	4.2		V

28C010ERP AC READ CHARACTERISTICS

PARAMETER	SYMBOL	MIN	MAX	UNITS	NOTES
Address to Output Delay	t_{ACC}		120	ns	(-12)
			150	ns	(-15)
			200	ns	(-20)
			250	ns	(-25)
CE\ to Output Delay ¹	t_{CE}		120	ns	(-12)
			150	ns	(-15)
			200	ns	(-20)
			250	ns	(-25)
OE\ to Output Delay ²	t_{OE}	0	50	ns	(-12)
			55	ns	(-15,-20,-25)
CE\ or OE\ to Output Float ^{3,4}	t_{DF}	0	50	ns	(-12)
			55	ns	(-15,-20,-25)
Output Hold from OE\, CE\ or Address, whichever occurred first	t_{OH}	0		ns	

Notes:

1. CE\ may be delayed up to $t_{ACC}-t_{CE}$ after the address transition without impact on t_{ACC}
2. OE\ may be delayed up to $t_{CE}-t_{OE}$ after falling edge of CE\ without impact on t_{CE} or by $t_{ACC}-t_{OE}$ after an address change without impact on t_{ACC} .
3. t_{DF} is specified from OE\ or CE\ whichever occurs first ($C_L=5pF$).
4. Guaranteed by design.

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28C010ERP AC WRITE CHARACTERISTICS

PARAMETER	SYMBOL	MIN	MAX	UNITS
Address, OE\ Set-up Time	t_{AS}, t_{OES}	0		ns
Address Hold Time	t_{AH}	50		ns
Chip Select Set-up Time	t_{CS}	0		ns
Chip Select Hold Time	t_{CH}	0		ns
Write Pulse Width (WE\ or CE\)	t_{WP}	100		ns
Data Set-up Time	t_{DS}	50		ns
Data, OE\ Hold Time	t_{DH}, t_{OEH}	0		ns
Write Cycle Time	t_{WC}		10	ms

28C010ERP PAGE MODE CHARACTERISTICS

PARAMETER	SYMBOL	MIN	MAX	UNITS
Write Cycle Time	t_{WC}		10	ms
Address Set-up Time	t_{AS}	0		ns
Address Hold Time	t_{AH}	50		ns
Data Set-up Time	t_{DS}	50		ns
Data Hold Time	t_{DH}	0		ns
Write Pulse Width	t_{WP}	100		ns
Byte Load Cycle Time	t_{BLC}		150	us
Write Pulse Width High	t_{WPH}	50		ns



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28C010ERP DATA POLLING CHARACTERISTICS⁽¹⁾

PARAMETER	SYMBOL	MIN	MAX	UNITS
Data Hold Time	t_{DH}	10		ns
OE\ Hold Time	$t_{OE\ H}$	10		ns
OE\ to Output Delay	t_{OE}		100	ns
Write Recovery Time	t_{WR}	0		ns

Note : 1. Guaranteed by design.

28C010ERP TOGGLE BIT CHARACTERISTICS⁽¹⁾

PARAMETER	SYMBOL	MIN	MAX	UNITS
Data Hold Time	t_{DH}	10		ns
OE\ Hold Time	$t_{OE\ H}$	10		ns
OE\ to Output Delay	t_{OE}		100	ns
OE\ High Pulse	t_{OEHP}	150		ns
Write Recovery Time	t_{WR}	0		ns

Note : 1. Guaranteed by design.

28C010ERP Package Ordering Guide

Package Style	Case Outline	1/	Description
G	F-32A		32 Pin Flat Package

Note:

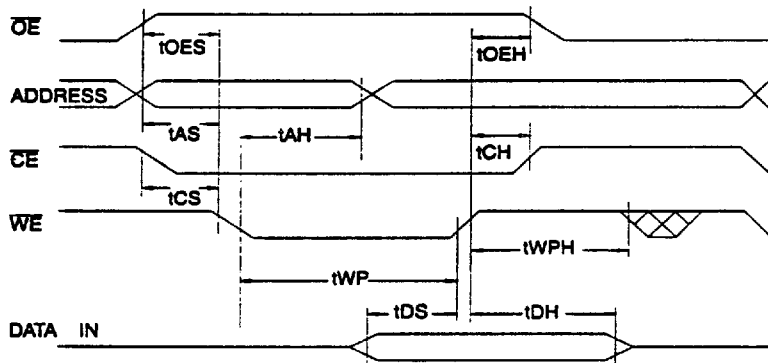
1/ For outline information, see Appendix A (Package Information - Outline Dimension)

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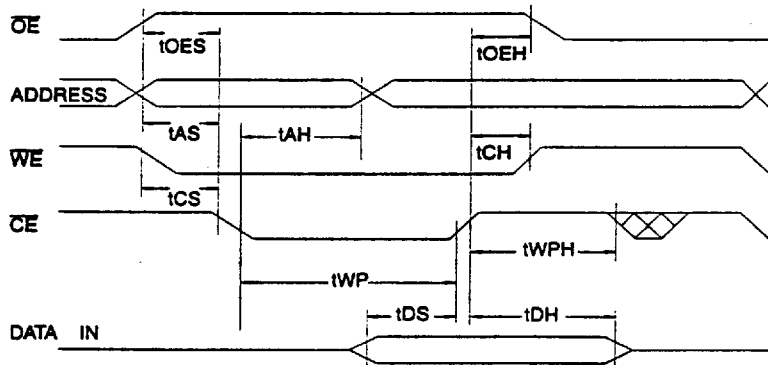
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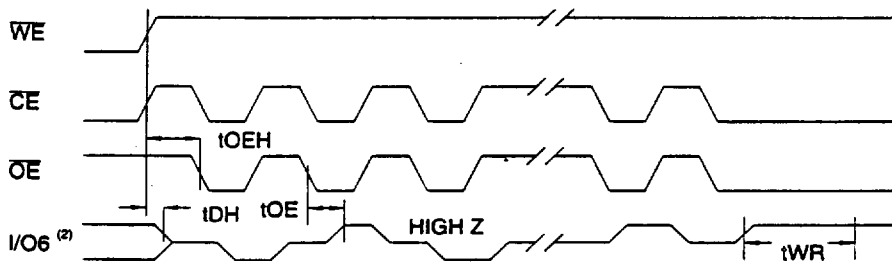
28C010ERP AC Write Waveforms - WE\ Controlled



28C010ERP AC Write Waveforms - CE\ Controlled



28C010ERP Toggle Bit Waveforms

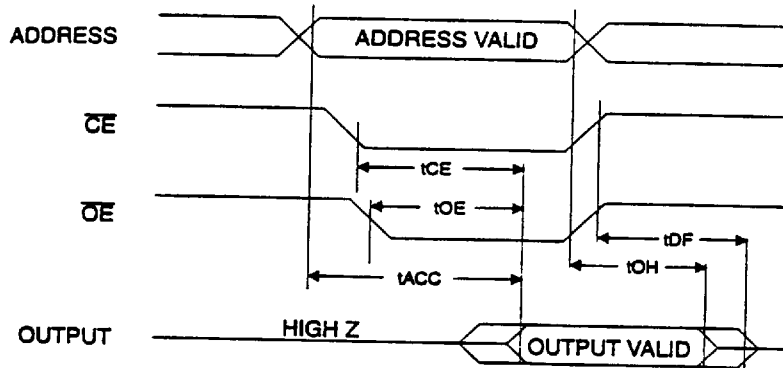


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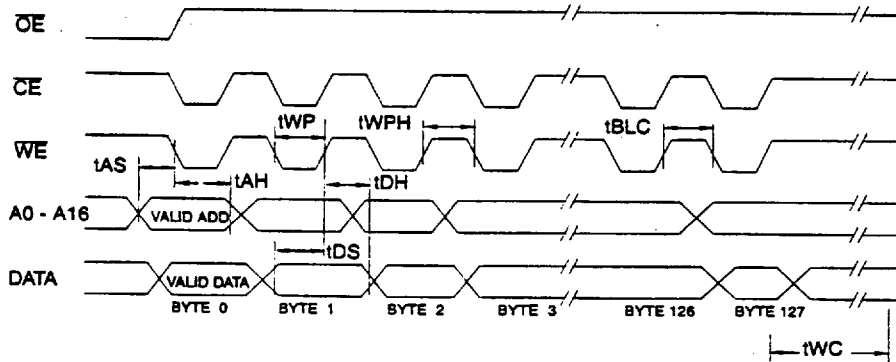
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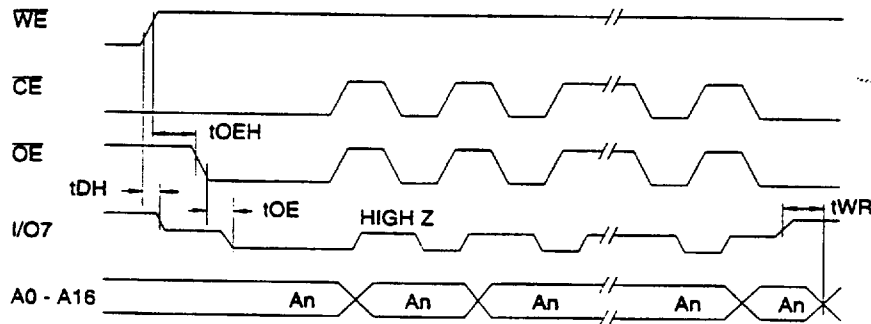
28C010ERP AC Read Waveforms



28C010ERP Page Mode Write Waveforms



28C010ERP Data Polling Waveforms



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