

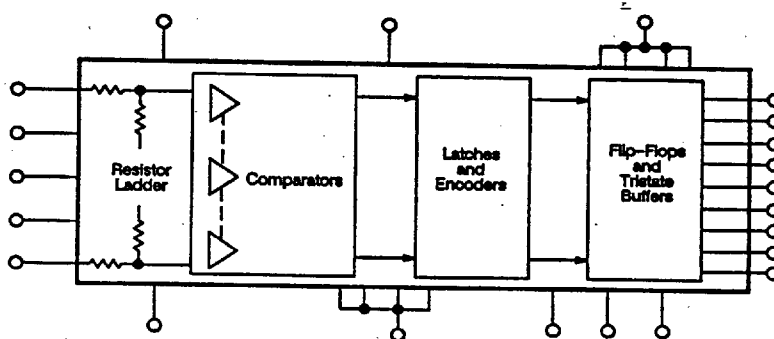
8 Bit A/D Converter - Radiation Hardened 7684RP

CMOS High Speed
Analog to Digital Converter

*For Space
Applications*

SEI's 7684RP (RP for RAD-PAK[®]) high speed 8 analog to digital converter features a minimum of 100 kilorad (Si) total dose tolerance. Using SEI's radiation hardened RAD-PAK[®] packaging technology, the

7684RP is fully equivalent to the commercial 7684 from Micro Power Systems. It is a 28 pin, 8 bit CMOS high speed analog to digital converter, which is designed for precision applications in video and data acquisition requiring conversion rates to 10 MHz with differential linearity error less than 1/2 LSB and low power consumption. One unique feature about the 7684RP is the input architecture which actually eliminates the need for an input track and hold and allows full scale input ranges from 1.2 to 5 Volts peak-to-peak, referred to ground or offset. To get the desired input range, the user needs to simply set $V_{REF(-)}$ and $V_{REF(+)}$. The 7684RP includes 256 clocked comparators, encoders, 3-state output buffers, a reference resistor ladder and associated timing circuitry. An overflow bit or flag is available to make it possible to achieve 9-bit resolution by connecting two devices in parallel. There is no effect on the data bits when the flag is in normal mode.



**SPACE
ELECTRONICS
INCORPORATED**

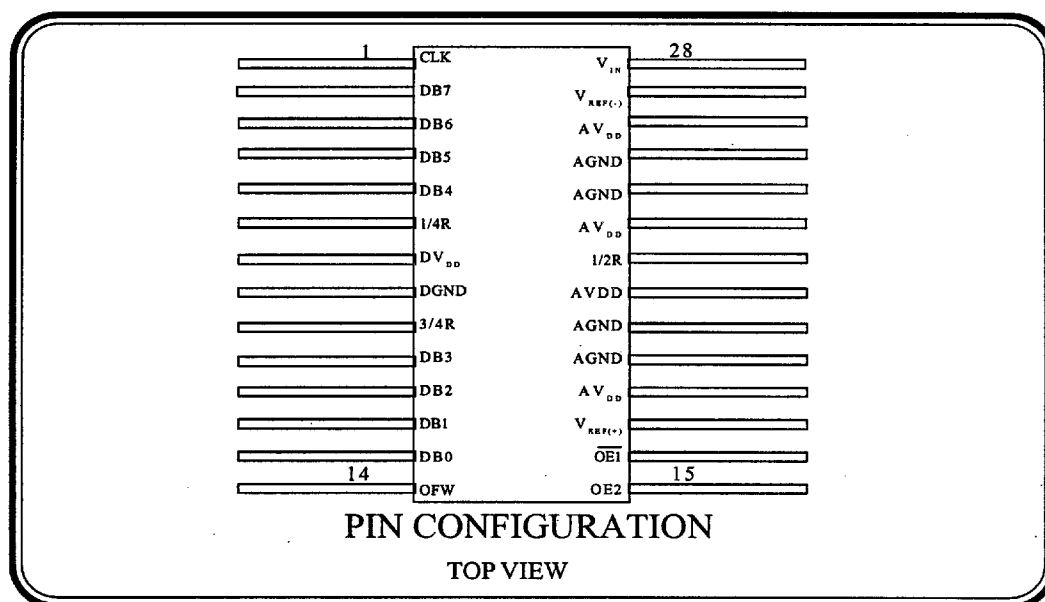
Tel: (619) 452-4167 Fax: (619) 452-5499
INTERNET: 102005.1635@COMPUSERVE.COM

■ 9011241 0000340 858 ■ 338

SEI 7684RP RADHARD 8 bit A to D CONVERTER

Radiation Hardened 7684RP

CMOS 8 Bit Flash
Analog to Digital Converter



Features:

- 8 Bit Organization
- Pin Compatible with MPS MP7684
- RAD-PAK® Radiation Hardened
Against Natural Space Radiation
- Total Dose Hardness >100 krad (Si)
- No Single Event Latchup > 120 MeV(mg/cm²)
- Package:
 - 28 Pin RAD-PAK® flat pack
(410 mils x 720 mils)
 - Weight – 5.2 grams
- High Speed Operation:
 - 0.001 to 15 MHz Sampling Rate
 - 1/2 LSB DNL to 10 MHz
- Monotonic; No Missing Codes
- High Speed LC²MOS Technology
 - Latchup Free
 - Single Power Supply:
4 to 6 Volts
 - Interface to Any Input Range between
GND and V_{DD}
 - No Sample/Hold Needed
 - Low Operating Power:
I_{cc} (max) = 90 mA
- Screening per TM 5004
- QCI per TM5005

Specifications and design are subject to change without notice.



March 1995

For Further Information Contact:

Space Electronics Inc.

4031 Sorrento Valley Blvd., San Diego, CA 92121

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

INTERNET: 102005.1635@COMPUSERVE.COM

7684RP ABSOLUTE MAXIMUM RATINGS^{1,2,3}

PARAMETER	SYMBOL	MIN	MAX	UNITS
V _{DD} to GND	V _{DD}		+7	V
V _{REF(+)} & V _{REF(-)}		GND-0.5	V _{DD} +0.5	V
All Inputs	V _{IN}	GND-0.5	V _{DD} +0.5	V
All Outputs	V _{OUT}	GND-0.5	V _{DD} +0.5	V
Operating Temperature	T _A	-55	+125	°C
Storage Temperature	T _{STG}	-65	+150	°C
Power Dissipation to 75°C Derates Above 75°C	P _D		1050 14	mW mW/°C

Notes:

1. Operation at or beyond these limits may result in permanent damage to the device.
2. Normal operation is not guaranteed at these extremes.
3. V_{DD} refers to AV_{DD} and DV_{DD}. GND refers to AGND and DGND.

7684RP ELECTRICAL CHARACTERISTICS¹

PARAMETER	SYMBOL	TYP ¹¹	MIN ¹⁰	MAX ¹⁰	UNITS
Resolution			8		Bits
Sampling Rate	F _S		0.1	10	MHz
Differential Non-Linearity	DNL			+1 1/2	LSB
Integral Non-Linearity, (Relative Accuracy)	INL			+2	LSB
Zero Scale Error	EZS	2			LSB
Full Scale Error	EFS	2			LSB
Dynamic Accuracy, Differential Non- Linearity	DNL	+0.3			LSB
Positive Ref. Voltage ³	V _{REF(+)}			AV _{DD}	V
Negative Ref. Voltage	V _{REF(-)}		AGND		V
Ladder Resistance	R _L		90	430	ohms
Ladder Temp. Coefficient ²	R _{TCO}			3000	ppm/°C
Input Voltage Range	V _{IN}		V _{REF(-)}	V _{REF(+)}	V _{DD}
Input Capacitance Sample ^{1,4}	C _{IN}	50			pF
Input Impedance ¹	Z _{IN}	10			Mohms
Aperture Delay ¹	t _{AP}	25			ns
Aperture Uncertainty (Jitter) ¹	t _{AJ}	60			pF
Logical "1" Voltage	V _{IH}		3.5		V
Logical "0" Voltage	V _{IL}			1.5	V



SPACE ELECTRONICS INC.

340

9011241 0000342 620

4031 SORRENTO VALLEY BLVD.

SAN DIEGO, CA 92121

PHONE: (619) 452-4167

FAX: (619) 452-5499

INTERNET: 102005.1635@COMPUSERVE.COM

7684RP ELECTRICAL CHARACTERISTICS² (continue)

PARAMETER	SYMBOL	TYP ¹¹	MIN ¹⁰	MAX ¹⁰	UNITS
Leakage Currents ⁵ V _{IN} =DGND to DV _{DD} CLK OE1 ¹⁷ OE2 ⁶	I _{IN}			± 100 75 1	μ A μ A μ A
Clock Timing Duty Cycle ¹		50			%
Logical "1" Voltage, I _{OQ0} =-1.0 mA	V _{OH}		4.3		V
Logical "0" Voltage, I _{OQ0} =2.0 mA	V _{OL}			0.6	V
Off Current	I _{OFF}	± 1			μ A
Output Capacitance ¹²	C _O	5			pF
Tristate Leakage, V _{OL0} =DGND to DV _{DD}	I _{OZ}	1		10	μ A
Data Hold Time ^{1,2}	t _{HD}	50			ns
Data Valid Delay ^{1,2}	t _{VD}	55			ns
Data Enable Delay ^{1,2}	t _{DEN}	40			ns
Data Tristate Delay ^{1,2}	t _{DTZ}	40			ns

Notes:

1. Typical value at T_A=25°C.
2. Guaranteed by design.
3. Values guaranteed for functionality.
4. Switched capacitor analog input requires driver with low output resistance.
5. All inputs have diodes to DV_{DD} and DGND. Input OE1\ has internal pull down. Input OE2 has internal pull up. Input DC currents will not exceed specified limits for any input voltage between DGND and DV_{DD}.
6. Internal resistor to DV_{DD} biases unconnected input to active high logical level.
7. Internal resistor to GND biases unconnected input to active low logical level.
8. Condition to meet aperture delay specifications (t_{AP}, t_{AL}). Actual rise/fall time can be less stringent with no loss of accuracy.
9. Unless otherwise noted: AV_{DD}=DV_{DD}=5V, F_S=10MHz (50% Duty Cycle), V_{REF(+)}=4.1V, V_{REF(-)}=AGND, T_A=25°C.
10. T_{MIN} to T_{MAX}.
11. At 25°C unless otherwise noted.

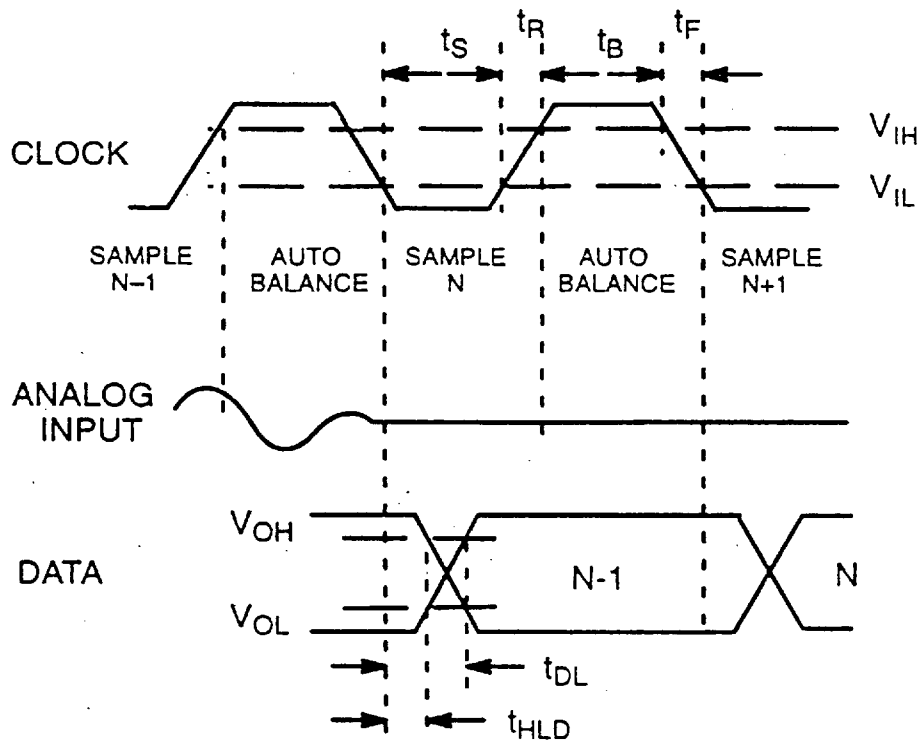

SPACE ELECTRONICS INC.

341

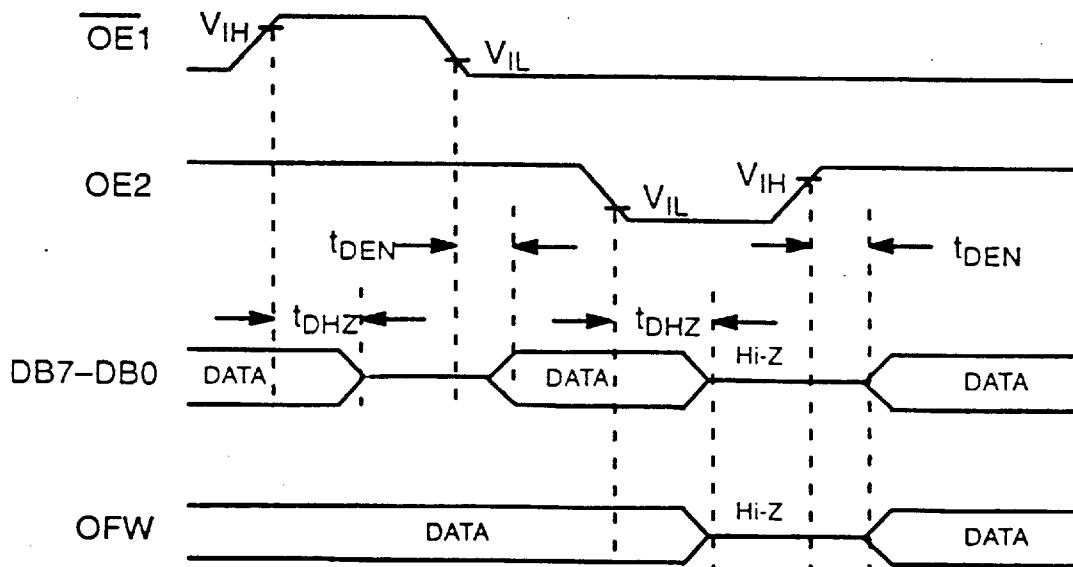
■ 9011241 0000343 567 ■

 4031 SORRENTO VALLEY BLVD.
 SAN DIEGO, CA 92121
 PHONE: (619) 452-4167
 FAX: (619) 452-5499
 INTERNET: 102005.1635@COMPUSERVE.COM

Timing Diagram



Output Enable/Disable Timing Diagram

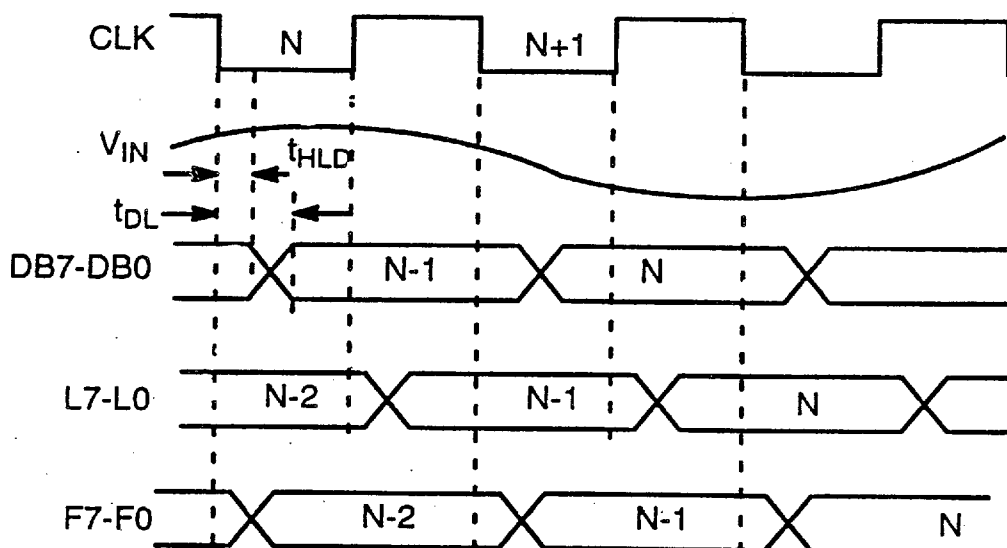


SPACE ELECTRONICS INC.

9011241 0000344 4T3 342

4031 SORRENTO VALLEY BLVD.
SAN DIEGO, CA 92121
PHONE: (619) 452-4167
FAX: (619) 452-5499
INTERNET: 102005.1635@COMPUSERVE.COM

Functional Equivalent Circuit and Interface Timing



7684RP PINOUT

PIN	SIGNAL	DESCRIPTION
1	CLK	Clock Input Pin
2	DB7	Data Bit 7 (MSB)
3	DB6	Data Bit 6
4	DB5	Data Bit 5
5	DB4	Data bit 4
6	1/4R	1/4 of Resistance Ladder
7	DVdd	Power Supply of Digial Circuit
8	DGND	Digital Ground
9	3/4R	3/4 of Resistance Ladder
10	DB3	Data Bit 3
11	DB2	Data Bit 2
12	DB1	Data Bit 1
13	DB0	Data Bit 0 (LSB)
14	OFW	Digital Output Overflow Pin
15	OE2	Output Enable Control Pin
16	OE1	Output Enable Control Pin
17	Vref(+)	Positive Reference Voltage Pin
18	AVdd	Power Supply of Analog Circuit
19	AGND	Analog Circuit Ground
20	AGND	Analog Circuit Ground
21	AVdd	Power Supply of Analog Circuit
22	1/2D	Center of Resistance Ladder
23	AVdd	Power Supply of Analog Circuit
24	AGND	Analog Ground
25	AGND	Analog Ground
26	AVdd	Power Supply of Analog Circuit
27	Vref(-)	Negative Reference Voltage Pin
28	Vin	Analog Input



SPACE ELECTRONICS INC.

343

9011241 0000345 33T

4031 SORRENTO VALLEY BLVD.

SAN DIEGO, CA 92121

PHONE: (619) 452-4167

FAX: (619) 452-5499

INTERNET: 102005.1635@COMPUSERVE.COM