

# SPACE PRODUCTS SELECTION GUIDE



## 45+ Year History of Supplying High Reliability Space Level Components

Analog Devices space qualified products are supported by more than four decades of flight heritage and expertise. With the addition of Linear Technology, our combined product portfolio, technology base, and specialist resources strengthen our capability to provide innovative analog, RF, power, and mixed-signal data conversion solutions for next-generation satellite and planetary spacecraft.

With our broad portfolio of robust, reliable, and radiation-tolerant products; technical capabilities; and system-level knowledge, we're proud to help customers confidently develop designs that perform in the most demanding environments and fulfill the most challenging mission objectives of today and tomorrow.

With knowledge, expertise, and access to technologies such as silicon on insulator, bipolar, CMOS, GaAs, SiGe, and InP, Analog Devices provides a unique blend of world-class devices and leading-edge performance and capabilities.

To address the most challenging applications, our space portfolio is offered in die form with Class K die qualifications, as monolithic hermetic devices, or as a fully integrated solution in the form of a system in a package. We support MIL-PRF-38535 for QMLV space grade devices and source controlled drawings for specific customer requirements, and we can perform radiation testing for total dose, ELDRS, and single event effects to guarantee product performance in the harsh environment of space.

The Analog Devices Space Products Group is dedicated to supporting space flight and satellite applications and is committed to the long-term support of the space market. Our purpose is to provide leading-edge, space qualified products and services to customers who require innovative solutions to achieve a competitive position in their markets.



## Radiation Testing

The Analog Devices Space Products Group understands the requirement for radiation-tolerant devices and continues to offer products with total ionizing dose (TID) guaranteed levels. Generic test reports for products with a TID guarantee can be found at [analog.com/adev](http://analog.com/adev).

Moving forward with the space community, Analog Devices will offer a number of products that are low dose rate tested. Furthermore, future product offerings will include SEE test data for customer review. Please contact us at [aero@analog.com](mailto:aero@analog.com) for the latest radiation information updates.

## Processing Flows

The Space Products Group is committed to releasing state-of-the-art products to meet the rigorous demands of the space market. Products offered are processed and manufactured to meet the space environment's needs.

Product offerings include QML Class V devices with radiation qualification and continued support on JAN S products. These products are screened to the guidelines of the MIL-PRF-38535 QML Class V processing flow.

Analog Devices also offers products processed through our internal standard space level products program, which provides a lower cost, shorter lead time alternative to source control drawings if the device is not offered as an SMD or JAN S. The processing of these products is based on the current issue of MIL-PRF-38535 QML Class V. Electrical parameters and screening exceptions (if any) are described in the current revision of the Analog Devices space level data sheet for each part offered.

Features of the Analog Devices standard space level products program include the following:

- ▶ MIL-PRF-38535 QML Class V certified facilities (fab, assembly, and test) unless otherwise noted on the product data sheet
- ▶ Parallel processing that mirrors the QML Class V flow, unless otherwise noted
- ▶ Wafer lot acceptance and SEM available on most products
- ▶ Wafer lot traceability
- ▶ Hot solder dip lead finish as described in MIL-PRF-38535
- ▶ Marking with standard part number, lot seal date code, and Analog Devices logo
  - Technology conformance inspection Group C and Group D generic data may be available
  - Group C and Group D can be performed at customer's request
- ▶ Product change notification

Analog Devices will continue to support devices to specific source control drawings. However, in most cases, the standard Analog Devices space level products should satisfy most customer requirements for full process control, traceability, and reliability through certified manufacturing, assembly, and test lines.

## Space Grade Dice Offering

The Analog Devices Space Products Group provides Class K space qualified chips (dice) on most products, which include die qualification as described in MIL-PRF-38534, Appendix C, Table C-II. Dice are fully traceable to the wafer lot or, if requested, to the individual wafer. All space level die/chips are available only through the Analog Devices Space Products Group and franchised distributors.

## Multichip Modules and Assemblies:

Analog Devices is an innovative designer and manufacturer of analog, digital, RF, microwave, and mixed-signal assemblies for instrumentation, space, defense, aerospace, medical, and wireless applications covering dc to 110 GHz. Our unique composite of semiconductor technologies, world-class products, and leading-edge capabilities allow us to support the most demanding military and space transmitter and receiver modules and assemblies. ADI is a one stop solution provider with the ability to offer custom, high reliability assemblies designed, developed, and manufactured in-house from the IC level to complex subsystems. ADI's in-house capability and facilities also include the ability to qualify products to MIL-PRF-38534 as applicable. In doing so, ADI provides unparalleled value and service to our customers through our ability to control cost, performance, schedule, obsolescence, and reliability.

## Analog-to-Digital Converters

Part Number	Description	Bits	Speed (MSPS)	Supply (V)	Differential Nonlinearity (25°C)	Power Dissipation (mW)	Interface	Package
AD670S	8-bit signal conditioning	8	0.1	±15, ±5	No missing codes	225	Parallel	DIP
AD9058S	8-bit, dual 50 MSPS	8	50	±5	±0.5 LSB	770	Parallel	DIP
AD9283S	8-bit, 100 MSPS	8	100	3	±1.25 LSB	115	Parallel	LCC
AD9054AS	8-bit, 200 MSPS	8	200	5	±1.5 LSB	700	Parallel	LCC
AD571S	10-bit complete ADC	10	0.025	+4.5 to +5.5, -13.5 to -16	±3 LSB	275	Parallel	Flatpack, DIP
AD574S	12-bit with processor interface	12	0.029	±12, ±5	No missing codes	725	Byte, parallel	Flatpack, DIP
AD1671S	12-bit, 1.25 MSPS	12	1.25	±5	±1 LSB	750	Parallel	Flatpack
AD1672S	12-bit, 3 MSPS	12	3	5	±1.5 LSB	240	Parallel	Flatpack
AD9042S	12-bit, 41 MSPS	12	41	5	±2 LSB	595	Parallel	Flatpack, DIP
AD6645S	14-bit, 80 MSPS	14	80	3.3, 5	±1.5 LSB	1750	Parallel	Flatpack
AD9254S	14-bit, 150 MSPS, 1.8 V	14	150	1.8 to 3.3	±1 LSB	408	Parallel	Flatpack
AD9246S	14-bit, 125 MSPS, 1.8 V	14	125	1.8 to 3.3	±1 LSB	395	Parallel	Flatpack
LTC1604A	16-bit, 333 kSPS	16	0.333	±5	±1 LSB	350	Parallel	SSOP
RT2378-20	20-bit, 1 MSPS, SAR ADC	20	1	+2.5	No missing codes	21	Serial	MSOP

## Digital-to-Analog Converters

Part Number	Description	Single or Dual Supply	Supply (V)	Input	Settling Time (ns)	Integral Nonlinearity (25°C)	Power Dissipation (mW)	Package
AD9731S	10-bit, 170 MSPS DAC	Single	±5 (logic), -5	Parallel	3.8	±1 LSB	439	Flatpack, DIP
AD768S	16-bit, 30 MSPS DAC	Dual	±5	Parallel	25	±9 LSB	600	Flatpack, DIP
DAC08S	8-bit, high speed multiplying DAC	Dual	±4.5 to ±18	Parallel	135	±0.19% FS	48	Flatpack, DIP, LCC
AD561S	10-bit current output DAC	Dual	+5 V <sub>CC</sub> , -15 V <sub>EE</sub>	Parallel	250	±1 LSB	500	DIP
AD565AS	12-bit current output complete	Dual	±15	Parallel	250	±13 LSB/4 LSB	345	Flatpack, DIP
DAC100S	10-bit current output DAC	Dual	±6 to ±18	Parallel	375	±0.1% FS	500	DIP
AD667S	12-bit microprocessor compatible	Dual	±12, ±15	Byte, parallel	3000	±1 LSB/2 LSB	555	Flatpack, DIP

## Clock and Timing

Part Number	Description	Supply (V)	Output Frequency (GHz)	No. of Inputs	No. of Outputs	Random Jitter (ps rms)	Clock Function	Output Logic
ADCLK925S	Ultrafast SiGe ECL clock/data buffers	3.3	6	1	2	60 FS	Clock fanout buffer	ECL

## Interface and Isolation

Part Number	Description	No. of Inputs		Insulation Rating (V rms)	Max Data Rate (Mbps)	Propagation Delay (ns)	Supply (V)	Operating Temperature (°C)
		Side 1	Side 2					
ADuM7442S	Quad-channel digital isolator	2	2	200	25	56	5.5	-55 to +125
ADuM141ES*	Quad-channel digital isolator	3	1	200	150	13	1.8 to 5	-55 to +125

\* In development.

## Isolation Amplifier

Part Number	Description	Number of Channels	Initial Accuracy	Insulation Rating (V rms)	BW 3 dB Typ (kHz)	Supply (V)	Operating Temperature (°C)
ADuM3190S*	High stability isolation amplifier	1	0.5%	200	400	3 to 20	-55 to +125

\* In development.

## Low Offset Operational Amplifiers

Part Number	Description	No. of Amps	Supply (V)	$V_{os}$ ( $\mu$ V)	$V_{os}$ Drift ( $\mu$ V/ $^{\circ}$ C)	Input Noise (nV/ $\sqrt$ Hz)	GBW (MHz)	CMRR (dB)	Supply (mA)	Package
AD8629S	Dual, low offset, precision op amp	2	2.7 to 5	$\pm$ 10	0.06	22	2.5	120	2.2	Flatpack
OP77S	Low offset op amp	1	$\pm$ 3, $\pm$ 18	$\pm$ 25	0.6	11	0.4	120	2	Can, flatpack, DIP, LCC
OP07S	Ultralow offset voltage op amp	1	$\pm$ 5, $\pm$ 20	$\pm$ 25	0.6	12	0.6	110	4	Can, flatpack, DIP
OP27S	Low noise, precision op amp	1	$\pm$ 15	$\pm$ 25	0.6	4	5	114	4.67	Can, flatpack, DIP, LCC
OP37S	Low noise, precision, high speed op amp	1	$\pm$ 15	$\pm$ 25	0.6	3	68	114	4.67	Can, flatpack, DIP, LCC
RH27AE	Precision op amp	1	$\pm$ 15	$\pm$ 35	1	3.8	5	114	4.67	Flatpack
RH27E	Precision op amp	1	$\pm$ 15	$\pm$ 55	1	3.8	5	114	4.67	Can, flatpack
ADA4077-2S	Low offset and drift, high precision amp	2	$\pm$ 2.5, $\pm$ 15	$\pm$ 65	0.25	13	3.6	120	0.650	Flatpack
RH07	Precision op amp	1	$\pm$ 15	$\pm$ 75	1.3	11	0.4	110	4	Can, flatpack, DIP
OP200S	Dual, low offset, low power op amp	2	$\pm$ 15	$\pm$ 75	0.5	11	0.5	120	1.45	DIP, LCC
OP270S	Dual, very low noise, precision op amp	2	$\pm$ 15	$\pm$ 75	1	11	5	106	6.5	Flatpack, DIP, LCC
AD8671S	Low noise, low input bias current op amp	1	$\pm$ 5, $\pm$ 15	$\pm$ 75	0.5	3.8	10	100	3.5	Flatpack
OP227S	Dual, low noise, low offset instrumentation op amp	2	$\pm$ 15	$\pm$ 80	1	3.9	5	114	6	Flatpack, DIP
RH1128	20 MHz, ultralow noise, precision, high speed op amp	1	$\pm$ 15	$\pm$ 80	1	1.6	11	110	10.5	Flatpack
RH1028	75 MHz, ultralow noise, precision, high speed op amp	1	$\pm$ 15	$\pm$ 80	1	1.6	50	110	10.5	Flatpack
OP207S	Dual, ultralow $V_{os}$ matched op amp	2	$\pm$ 15	$\pm$ 100	1.3	24	0.6	106	8	DIP
RH27C	Precision op amp	1	$\pm$ 15	$\pm$ 100	1.8	4.5	5	100	5.67	Can, flatpack, DIP
RH37	Precision op amp	1	$\pm$ 15	$\pm$ 100	1.8	4.5	45	100	5.67	Can, flatpack, DIP
OP400S	Quad, low offset, low power op amp	4	$\pm$ 15	$\pm$ 150	1.2	22	0.5	120	2.9	Flatpack, DIP, LCC
OP484S	Precision rail-to-rail op amp	4	$\pm$ 15	$\pm$ 200	2	3.9	4.5	86	5.8	Flatpack, DIP
RH1013	Dual precision op amp	2	$\pm$ 15	$\pm$ 300	2.5	22	0.5	97	1.1	Can, flatpack, DIP
RH1014	Quad precision op amp	4	$\pm$ 15	$\pm$ 300	2.5	22	0.5	97	2.2	Flatpack, DIP
OP22S	Programmable micropower op amp	1	$\pm$ 15	$\pm$ 300	0.75	22	10	100	12.5	Can
ADA4084-4S	Low noise, low power, RRIO quad op amp	4	$\pm$ 1.5, $\pm$ 15	$\pm$ 300	1.25	3.9	12	64	0.625	Flatpack
ADA4084-2S	Low noise, low power, RRIO dual op amp	2	$\pm$ 1.5, $\pm$ 15	$\pm$ 300	1.75	3.9	12	64	0.625	Flatpack
RH108A	General-purpose op amp	1	$\pm$ 15	$\pm$ 500	5	—	0.5	96	0.6	Can, flatpack, DIP
OP11S	Quad, matched, 741 type op amp	4	$\pm$ 15	$\pm$ 500	1	12	3	100	12	Flatpack, DIP
RH1498	10 MHz, dual rail-to-rail precision op amp	2	$\pm$ 15	$\pm$ 800	1	12	6.8	90	5	Flatpack
RH1499	10 MHz, quad rail-to-rail precision op amp	4	$\pm$ 15	$\pm$ 800	1	12	6.8	90	10	Flatpack

## Low Bias Operational Amplifiers

Part Number	Description	No. of Amps	Supply (V)	$V_{os}$ ( $\mu$ V)	Input Bias (nA)	Slew (V/ $\mu$ s)	CMRR (dB)	Supply (mA)	Package
AD648S	Dual, precision, low power, BiFET op amp	2	$\pm$ 18	$\pm$ 2000	0.02	1	76	0.4	Can, DIP
ADA4610-2S	Low noise, precision RRIO, JFET dual op amp	2	$\pm$ 15	$\pm$ 400	0.02	17	100	1.85	Flatpack
OP15S	Precision, JFET input op amp	1	$\pm$ 15	$\pm$ 500	0.05	10	86	4	Can, flatpack, DIP
OP16S	Precision, JFET input op amp	1	$\pm$ 20	$\pm$ 500	0.05	18	86	7	Can, flatpack, DIP
RH1056A	Precision, high speed, JFET op amp	1	$\pm$ 15	$\pm$ 300	0.05	10	86	6.5	Can, flatpack
OP215S	Dual, precision, JFET input op amp	2	$\pm$ 15	$\pm$ 1000	0.1	10	86	8.5	Can, DIP, LCC
OP42S	High speed, fast settling, precision, JFET input op amp	1	$\pm$ 15	$\pm$ 1000	0.2	45	86	6	Can, DIP
PM108S	Low input current op amp	1	$\pm$ 5, $\pm$ 20	$\pm$ 500	2	0.05	96	0.6	Can, flatpack, DIP
OP12S	Precision, low input current op amp	1	$\pm$ 15	$\pm$ 150	2	0.12	104	0.6	Can
PM156S	Monolithic, JFET input op amp	1	$\pm$ 5, $\pm$ 20	$\pm$ 2000	3.5	10	85	7	Can, DIP
PM155S	Monolithic, JFET input op amp	1	$\pm$ 5, $\pm$ 20	$\pm$ 2000	3.5	3	85	4	Can, DIP

## High Speed, Low Noise Operational Amplifiers

Part Number	Description	No. of Amps	Supply (V)	$V_{os}$ ( $\mu$ V)	GBW (MHz)	Input Noise ( $nV/\sqrt{Hz}$ )	Input Bias (nA)	Slew ( $V/\mu$ s)	CMRR (dB)	Supply (mA)	Package
AD847S	High speed, low power op amp	1	$\pm 5, \pm 15$	$\pm 1000$	25	15	5000	300	80	5.7	DIP
AD844S	60 MHz, 2000 $V/\mu$ s current feedback op amp	1	$\pm 5, \pm 15$	$\pm 300$	60	2	400	2000	70	7.5	DIP, LCC
RH6200	165 MHz, low noise rail-to-rail op amp	1	$+5, \pm 5$	$\pm 600$	110	2.3	18000	31	65	20	Flatpack
AD8041S	160 MHz, rail-to-rail amp with disable op amp	1	$3, 5, \pm 5$	$\pm 9500$	160	16	3400	160	70	6.1	Flatpack, DIP
AD8001S	800 MHz, 50 mW current feedback op amp	1	$\pm 5$	$\pm 5500$	350	2	6000	800	50	5.5	Flatpack, DIP

## High Speed/Differential Amplifiers

Part Number	Description	No. of Amps	Supply (V)	$V_{os}$ ( $\mu$ V)	Slew ( $V/\mu$ s)	Input Noise ( $nV/\sqrt{Hz}$ )	-3 dB (MHz)	CMRR (dB)	Supply (mA)	Package
RH1814	100 MHz quad differential amp	4	$5, \pm 5$	$\pm 1500$	500	8	200	75	14.4	Flatpack
AD8138S	Low distortion differential amp	1	$\pm 5$	$\pm 2500$	1500	17	320	64	21	Flatpack
AD8351S	Low distortion fully differential amp	1	5	10,000	13,000	2.9	450	35	33	LCC

## Low Power Amplifiers

Part Number	Description	No. of Amps	I/Q Amp ( $\mu$ A)	Supply (V)	$V_{os}$ ( $\mu$ V)	Input Noise ( $nV/\sqrt{Hz}$ )	Input Offset Current (nA)	Input Bias Current (nA)	Slew Rate ( $V/\mu$ s)
ADA4096-2S	30 V, micropower, overvoltage protection, RRIO, dual op amp	2	60	$\pm 1.5, \pm 15$	$\pm 300$	27	1.5	10	0.25
RH1078	Dual micropower precision op amp	2	75	$5, \pm 15$	$\pm 120$	24	0.8	15	0.04
ADA4084-2S	30 V, low noise, low power, RRIO, dual op amp	2	650	$\pm 1.5, \pm 15$	$\pm 300$	3.9	25	300	2.4
ADA4084-4S	30 V, low noise, low power, RRIO, dual op amp	4	650	$\pm 1.5, \pm 15$	$\pm 300$	3.9	25	300	2.4

## Comparators

Part Number	Description	Channels	Supply (V)	Response Time (ns)	$V_{os}$ (mV)	Input Offset Current ( $\mu$ A)	CMRR (dB)	Package
AD8561S	7 ns single comparator	1	$\pm 5$	9.8	7	$\pm 4$	60	Flatpack, DIP
RH1016	10 ns single precision comparator	1	$\pm 5$	12	3	$\pm 1$	80	Flatpack
PM111S	Precision voltage comparator	1	$\pm 15$	180	4	$\pm 0.01$	90	Can, DIP
RH119	80 ns dual comparator	2	$\pm 15$	200	4	$\pm 0.075$	90	Can, DIP, Flatpack
RH1011	150 ns general-purpose comparator	1	$\pm 15$	250	2	$\pm 0.004$	90	Can, DIP, Flatpack
PM139S	Quad, low power voltage comparator	4	$5$ to $30, \pm 18$	500	4	$\pm 0.025$	70	Flatpack, DIP, LCC

## Instrumentation Amplifiers

Part Number	Description	Channels	Single or Dual Supply	Supply (V)	Gain Range	$V_{os}$ ( $\mu$ V)	Noise ( $\mu$ V p-p)	Input Bias Current (nA)	Package
AD524S	Precision, monolithic instrumentation amp	1	Dual	$\pm 18$	1000	250	0.3	$\pm 50$	DIP, LCC
AMP01S	Low noise, precision instrumentation amp	1	Dual	$\pm 18$	10,000	100	13	$\pm 4$	Flatpack, DIP, LCC
AD8229S	Low noise instrumentation amp	1	Dual	$\pm 15$	1000	100	5	$\pm 150$	Flatpack

## Sample-and-Hold Amplifiers

Part Number	Description	Channels	Supply (V)	Supply Current (mA)	PSRR (dB)	Acquisition Time ( $\mu$ s)	Droop Rate ( $V/ms$ )	Slew Rate ( $V/\mu$ s)	Package
AD585S	High speed, precision sample-and-hold amp	1	$\pm 12, \pm 15$	10	70	3	0.001	10	Flatpack, DIP
SMP11S	Low droop rate, accurate sample-and-hold amp	1	$\pm 18$	7	77	3.5	0.0024	10	DIP

## Shunt Monitor

Part Number	Description	Minimum Common-Mode Input (V)	Maximum Common-Mode Input (V)	Bandwidth Typ (kHz) G = 10	Supply Voltage (V)	Voltage Offset (mV)	Supply Current	Package
AD8212S	High voltage current shunt monitor	7	65	1000	7 to 65	±2	720 µA	Flatpack
AD8210S	High voltage current shunt monitor	-2	65	450	5	±1.8	2 mA	Flatpack
RH6105	Precision rail-to-rail current sense amp	-0.3	44	100	2.85 to 36	±0.4	350 µA	Dice*

\* Packaged product available from third party, please contact factory for details.

## Voltage References

Part Number	Description	V <sub>OUT</sub> (V)	Accuracy (%)	Supply (V)	TC (ppm/°C)	Noise (µV p-p)	Package
AD589S	Precision, 1.2 V IC reference	1.2	1.2	Shunt type reference	50	5	Can
RH1034-1.2	1.2 V voltage reference	1.2 and 7 (aux)	4.5	Shunt type reference	60	4	Can, flatpack
REF43S	2.5 V, low power, precision voltage reference	2.5	0.02	4.5 to 40	15	4	Can, flatpack, DIP, LCC
AD584S	Pin-programmable, precision voltage reference	2.5, 5, 7.5, 10 programmable	0.05	4.5 to 30	15	50	Can
RH1009	2.5 V, precision voltage reference	2.5	0.2	Shunt type reference	35	—	Can, flatpack
RH1021-5	5 V, precision voltage reference	5	1.2 or 0.25	35; max input to output	5 or 20	5	Can, flatpack
REF02S	5 V, precision, voltage reference/temperature transducer	5	0.15	7 to 40	8.5	10	Can, flatpack, DIP, LCC
REF05S	5 V, precision voltage reference	5	0.15	15	8.5	15	Can, flatpack, DIP, LCC
RH129A	6.9 V voltage reference	6.9	4.3	Shunt type reference	10	28.2	Can
RH1021-7	7 V, precision voltage reference	7	0.7	35; max input to output	5	5.7	Can
RH1021-10	10 V, precision voltage reference	10	0.6 or 0.15	35; max input to output	5 or 20	8.5	Can, flatpack
REF01S	10 V, precision voltage reference	10	0.3	12 to 40	8.5	30	Can, flatpack, DIP, LCC
REF10S	10 V, precision voltage reference	10	0.15	15	8.5	30	Can, flatpack, DIP, LCC

## Linear Regulators—Positive Voltage

Part Number	Description	Output Current (A)	Input Voltage Range (V)	Dropout Voltage (V)	Load Regulation V <sub>OS</sub>	RMS Output Noise V <sub>OUT</sub>	Package
RH1086 (H)	0.5 A LDO regulator	0.5	25 V input to output differential	1.25	0.3%	0.003%	Can
RH117 (H)	0.5 A regulator	0.5	40 V input to output differential	1.8	0.3%	0.001%	Can
RH3080	0.9 A LDO single resistor regulator	0.9	1.2 to 36	0.45	±1 mV	40 µV	Dice*
RH1965	0.9 A LDO regulator with shutdown	0.9	1.8 to 20	0.435	±8 mV	40 µV	Dice*
RH1086 (K)	1.5 A LDO regulator	1.5	25 V input to output differential	1.5	0.3%	0.003%	Can
RH117 (K)	1.5 A regulator	1.5	40 V input to output differential	2.3	0.3%	0.001%	Can
RH3083	2.8 A LDO single resistor regulator	2.8	1.2 to 23	0.65	±3 mV	40 µV	Dice*
RH1085	3 A LDO regulator	3	30 V input to output differential	1.5	0.3%	0.003%	Can
RH1573	LDO PNP regulator driver	Up to 5	2.8 to 10	0.2	±2 mV	—	Dice*

\* Packaged product available from third party, please contact factory for details.

## Linear Regulators—Negative Voltage

Part Number	Description	Output Current (A)	Input Voltage Range	Dropout Voltage (V)	Load Regulation V <sub>OS</sub>	RMS Output Noise V <sub>OUT</sub>	Package
RH137 (H)	0.5 A negative regulator	0.5	30 V input to output differential	2.2	0.5%	0.003%	Can
RH137 (K)	1.5 A negative regulator	1.5	30 V input to output differential	2.2	0.5%	0.003%	Can
RH1185A	3 A LDO negative regulator	3	30 V input to output differential	1	0.3%	—	Can

## DC-to-DC Switching Regulators

Part Number	Description	Output Current (A)	Input Voltage Range (V)	Output Voltage (V)	Operating Frequency (kHz)	Synchronous	Package
RH1959	DC-to-DC switching regulator	Up to 4.5	4.3 to 16	Up to 15.5	500	No	Dice*
RH3845	DC-to-DC controller	Up to 10	7.5 to 60	Up to 36	100 to 500	Yes	Dice*
RHK3845	DC-to-DC controller and MOSFETS	Up to 10	7.5 to 60	Up to 36	100 to 500	Yes	Dice*

\* Packaged product available from third party, please contact factory for details.

## Analog Switches

Part Number	Description	Channels	Supply (V)	$R_{ON}$	Total Switching Time (ns)	Power Dissipation (mW)	Switch Type	Package
ADG201S	LCMOS, high speed, quad SPST switch	4	$\pm 15$	300	100	240	SPST	DIP
SW201S	Quad, SPST, JFET analog switch	4	$\pm 15$	75	100	470	SPST	DIP

## Muxes

Part Number	Description	Channels	Supply (V)	$R_{ON}$	Break-Before-Make Delay (ns)	Power Dissipation (mW)	Mux Type	Package
AD8182S	Dual, 2:1 buffered, 10 ns switching multiplexer	2	$\pm 5$	N/A	N/A	40	Single ended	Flatpack

## Matched Pair Transistors

Part Number	Description	Offset Voltage ( $\mu V$ )	Offset Voltage Tempco ( $\mu V/^\circ C$ )	Noise Voltage Density (nV/Hz)	Breakdown Voltage	Package
MAT02S	Low noise, matched dual NPN transistor	50	0.3	2	0.1	Can
MAT03S	Low noise, matched dual PNP transistor	100	0.5	2	0.1	Can, flatpack

## Multiplier

Part Number	Description	BW	Output Offset Voltage Drift	Multiplier Drift	Input Offset Current	Output Voltage Swing (V)	Package
AD534S	Internally trimmed, precision IC multiplier	1 MHz	$\pm 300 \mu V/^\circ C$	$\pm 0.01\%/^\circ C$	$\pm 2 \mu A$	$\pm 11$	Can, DIP

## Analog Front End

Part Number	Description	Resolution (Bits)	Sample Rate (MSPS)	Power Dissipation (mW)	INL (LSB)	DNL (LSB)	Package
AD9814S	14-bit, 3-channel CCD signal processor	14	10	450	11	1.25	Flatpack

## Temperature Transducer

Part Number	Description	25°C Temperature Error ( $^\circ C$ )	Sensor Output	Supply Voltage Range (V)	Package
AD590S	2-terminal IC temperature transducer	$\pm 2.5$	1 $\mu A/K$	4 to 30	Can, flatpack, DIP

## Voltage-to-Frequency Converter

Part Number	Description	Architecture	No. of Channels	Input Voltage Range	Full-Scale $f_{OUT}$ (kHz)	Reference Voltage	Gain Drift (ppm/ $^\circ C$ )	Supply (V)	Package
AD537S	Voltage-to-frequency converter	Nonsynchronous	1	$\pm 11$	150	5	$\pm 250$	$\pm 5$ to $\pm 18$	DIP
AD652S	Voltage-to-frequency converter	Synchronous	1	$\pm 10$	2500	5	$\pm 50$	$\pm 6$ to $\pm 18$	DIP

## Variable Gain Amplifiers

Part Number	Description	QML	Frequency (MHz)	Gain Range (dB)	Gain Scaling Factor (mV/dB)	Gain Conformance (dB)	Supply Voltage (V)	Supply Current (mA)	Package
AD8367S	500 MHz variable gain amp with on-chip square law detector	R703	10 to 500	-2.5 to +42.5	20	$\pm 0.5$	2.7 to 5	30	Flatpack

## RF and Microwave Space Qualified Class S and Class K Solutions

## Logarithmic Amplifiers

Part Number	Description	Frequency (MHz)	Dynamic Range (dB)	Temperature Stability (dB)	Response Time (ns typ)	Voltage Supply (V)	Supply Current (mA)	Package
AD8306S	5 MHz to 400 MHz, 100 dB, high precision limiting-logarithmic amp	5 to 400	100	±1	73	2.7 to 5.5	16	Flatpack
ADL5513S	1 MHz to 4 GHz, 80 dB logarithmic detector/controller	1 to 4000	80	±0.5	20	2.7 to 5.5	31	Flatpack

## RF Power Detectors

Part Number	Description	Frequency (MHz)	Response Time (ns)	Dynamic Range (dB)	Voltage Supply (V)	Temperature Stability	Supply (mA)	Package
ADL6010S	Fast responding, 45 dB range, envelope detector	500 MHz to 40 GHz	10	40	4.75 to 5.25	0.25	3	Flatpack
ADL5513S	Logarithmic detector/controller	1 to 4000	20	80	2.7 to 5.5	0.5	31	Flatpack
AD8306S	High precision, limiting logarithmic amplifier	5 to 400	73	100	2.7 to 6.5	1	16	Flatpack
ADL5501	RMS power detector	6000	6 µs	30	3 to 5	—	1.5	Flatpack

## Modulator

Part Number	Description	Function	Frequency (MHz)	I/Q Frequency (MHz)	Voltage Supply (V)	Max Supply Current (mA)	Standby Supply Current (µA)	Package
AD8346S	2.5 GHz direct conversion quadrature modulator	Mod	800 to 2500	70	2.7 to 5.5	55	20	Flatpack

## PLL

Part Number	Description	QML	Frequency (GHz)	Normalized Phase Noise (dBc/Hz)	Max REFIN Frequency (MHz)	RF Prescaler	Supply Voltage (V)	Supply Current (mA)	Package
ADF4108S	PLL frequency synthesizer	L703	7	-223	250	16/17, 32/33, 64/65, 8/9	3.2 to 3.6	15	Flatpack

## Amplifiers

Part Number	Frequency Range (GHz)	Product Description	Gain (dB)	OIP3 (dBm)	NF (dB)	P1dB (dBm)	Package	ECCN Code
ADH395S*	DC to 4	Gain block	15+	28	4.5	15	G8	EAR99
ADH313S*	DC to 6	Gain block	17	27	6.5	14	G8	EAR99
ADH463S*	2 to 20	Wideband LNA with AGC	14	28	2.5	16	Chip	EAR99
ADH499S*	21 to 32	Medium PA	16	33	5	24	Chip	3A001.b.2.d

\* Contact factory for the space version.

## Attenuators

Part Number	Frequency Range (GHz)	Product Description	Insertion Loss (dB)	Attenuation Range (dB)	IIP3 (dBm)	Control Input (VDC)	Package	ECCN Code
ADH429S*	DC to 3	6-bit digital	3	0.5 to 31.5	32	0/-5	G16	EAR99
ADH792S*	DC to 6	6-bit digital	1.8	0.25 to 15.75	55	TTL/CMOS	Chip	EAR99
ADH346S*	DC to 8	Analog VVA	2	0 to 30	10	0 to -3	G8	EAR99
ADH424S*	DC to 13	6-bit digital	4	0.5 to 31.5	32	0/-5	Die	EAR99
ADH346S*	DC to 20	Analog VVA	2.2	0 to 25	10	0 to -3	Die	EAR99

\* Contact factory for the space version.



## Mixers

Part Number	Frequency (GHz)	Product Description	IF Frequency (GHz)	Conversion Gain (dB)	LO/RF Isolation (dB)	IIP3 (dBm)	Package	ECCN Code
ADH207S*	0.7 to 2	10 LO, double balanced	DC to 0.3	-9	45	17	G8	EAR99
ADH128S*	1.8 to 5	15 LO, double balanced	DC to 2	-10	40	18	G8	EAR99
ADH1048S*	2 to 18	Double balanced	DC to 4	-10	35	19	Chip	EAR99
ADH141S*	6 to 18	15 dBm LO, double balanced	DC to 6	-10	25	21	Die	EAR99
ADH329S*	25 to 40	13 LO, double balanced	DC to 8	-9.5	42	19	Chip	EAR99
ADH1015S*	26 to 32	13 dBm LO, triple balanced	16 to 22	-10	45	22	Die	EAR99

\* Contact factory for the space version.

## Frequency Multiplier

Part Number	Frequency (GHz)	Product Description	Output Frequency (GHz)	Input Power (dBm)	Output Power (dBm)	100 kHz SSB Phase Noise (dBc/Hz)	Package	ECCN Code
ADH561S*	4.0 to 10.5	×2 active	8 to 21	5	17	-139	Chip	EAR99

\* Contact factory for the space version.

## Phase Shifter

Part Number	Frequency (GHz)	Product Description	Insertion Loss (dB)	Phase Range (°)	2 <sup>nd</sup> Harmonic Pin = -10 dBm (dBc)	Control Voltage Range (VDC)	Package	ECCN Code
ADH936S*	1.2 to 1.4	6-bit digital	4	5.625 to 360	45	0/5	G24	EAR99

\* Contact factory for the space version.

## Switches

Part Number	Frequency Range (GHz)	Product Description	Insertion Loss (dB)	Isolation (dB)	Input P1 dB (dBm)	Control Input (VDC)	Package	ECCN Code
ADH344S*	DC to 4	SP4T	2	40	21	0/-5	G16	EAR99
ADH244S*	DC to 4	SP4T	0.7	40	25	TTL/CMOS	G16	EAR99
ADH232S*	DC to 6	SPDT, high isolation	1.4	43	26	0/-5	G8	EAR99
ADH231S*	DC to 6	SPST, high isolation	1.4	52	27	0/-5	G7	EAR99
ADH344S*	DC to 12	SP4T	1.8	42	27	0/-5	LH5	EAR99
ADH232S*	DC to 15	SPDT, high isolation	1.4	50	26	0/-5	Die	EAR99
ADH347S*	DC to 20	SPDT, high isolation	1.7	45	23	0/-5	Chip	EAR99

\* Contact factory for the space version.

### Space Level Heritage

We have custom upscreened many RF and microwave solutions to MIL-PRF-38535 Class S, NASA EEE-INST-002, and customer specific requirements. Parts have been provided as die, chip-in-a-package, and complex hybrid designs. Below is an extensive list of generic parts that we have provided to our customers for space flight.

Technology	GaAs HBT	GaAs MESFET	GaAs PHEMT	GaAs PIN
Products	<b>Amplifiers</b> HMC311, HMC313, HMC395, HMC397, HMC431, HMC606  <b>Analog Phase Shifter</b> HMC247  <b>Frequency Dividers</b> HMC361, HMC363, HMC365, HMC437, HMC438, HMC439  <b>Frequency Detectors</b> HMC439, HMC440  <b>Frequency Multipliers</b> HMC443  <b>PLOs</b> HMC698  <b>VCOs</b> HMC358, HMC384, HMC386, HMC391, HMC416, HMC430, HMC431, HMC506, HMC508, HMC509, HMC510, HMC511, HMC512, HMC529, HMC530, HMC531, HMC534, HMC586, HMC587, HMC588, HMC732	<b>Amplifiers</b> HMC392  <b>Attenuators (Digital)</b> HMC290, HMC306, HMC335, HMC424, HMC425, HMC470  <b>Attenuators (VVA)</b> HMC346, HMC473, HMC712, HMC985  <b>Frequency Multipliers</b> HMC158, HMC205, HMC812, HMC1105  <b>Mixers</b> HMC128, HMC129, HMC130, HMC141, HMC142*, HMC143, HMC207, HMC213A, HMC220, HMC258, HMC260, HMC292, HMC329, HMC422, HMC423, HMC522, HMC524, HMC553, HMC554, HMC557, HMC558, HMC560, HMC773, HMC774, HMC787, HMC1015, HMC1048  <b>Modulators</b> HMC135  <b>Phase Shifters</b> HMC648  <b>Switches</b> HMC183, HMC231, HMC232, HMC244, HMC252, HMC276, HMC322, HMC344, HMC347, HMC427, HMC607	<b>Amplifiers</b> HMC263, HMC441, HMC442, HMC451, HMC462, HMC463, HMC465, HMC498, HMC499, HMC516, HMC517, HMC519, HMC566, HMC605, HMC616*, HMC659, HMC715, HMC788, HMC870, HMC871, HMC902, HMC903, HMC-ALH216, HMC-ALH376, HMC-ALH444, HMC5840*  <b>Attenuators (Digital)</b> HMC941, HMC939  <b>Frequency Multipliers</b> HMC448, HMC449*, HMC573  <b>Mixers</b> HMC264  <b>Phase Shifters</b> HMC936  <b>Switches</b> HMC849	<b>Attenuators (VVA)</b> HMC-VVD106

\* Contact factory for the space version.

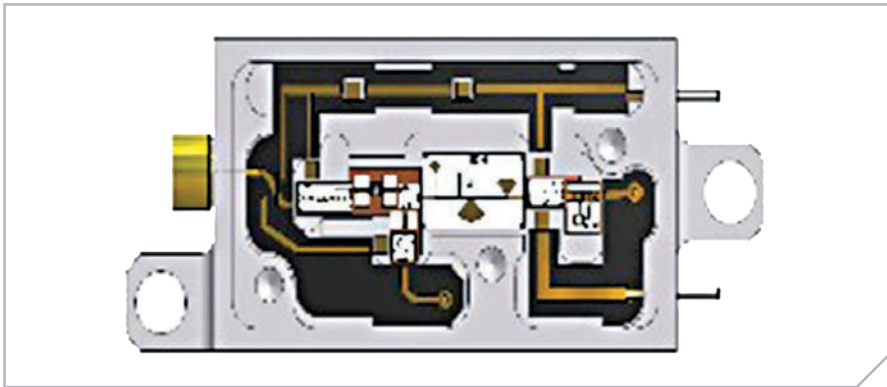
Technology	SiGe HBT	SiGe BiCMOS
Products	<b>Amplifiers</b> HMC471, HMC476, HMC479, HMC482  <b>Frequency Dividers</b> HMC862  <b>Modulators</b> HMC495	<b>Comparators</b> HMC675  <b>Clock Divider</b> HMC988  <b>Fan-Out Buffer</b> HMC987  <b>Flip Flop</b> HMC747  <b>PLL</b> HMC703, HMC704

## Space Assemblies

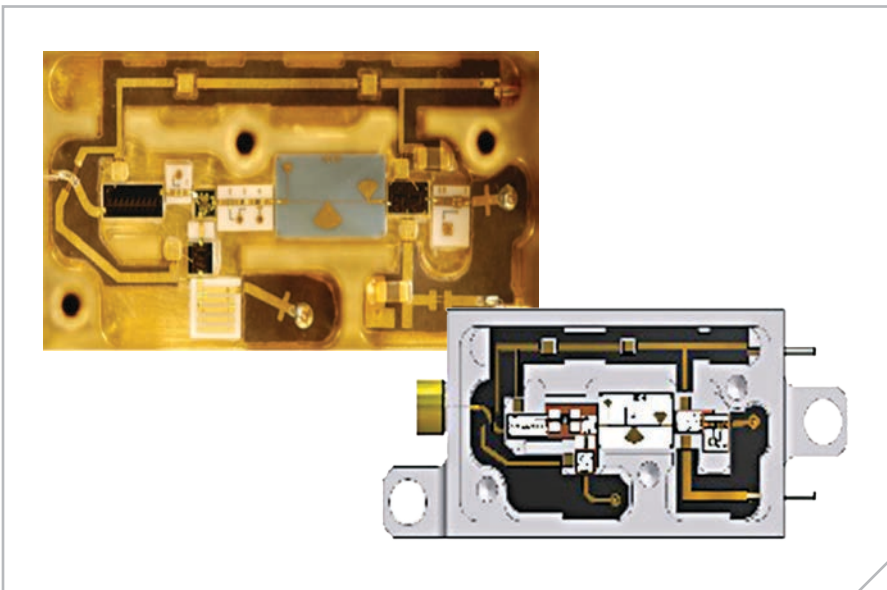
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