Actel FPGAs for Space Applications

- *Total Dose Capabilities from 5K rads to 1M rad*
- *Latch-up Immune*
- *Device Capacities from 4,000 to 32,000 Available Gates*
- *Highly Reliable, Non-Volatile Antifuse Technology Meets the Most Stringent Quality Requirements*
- *Live on Power-Up*
- *Low Power Consumption*

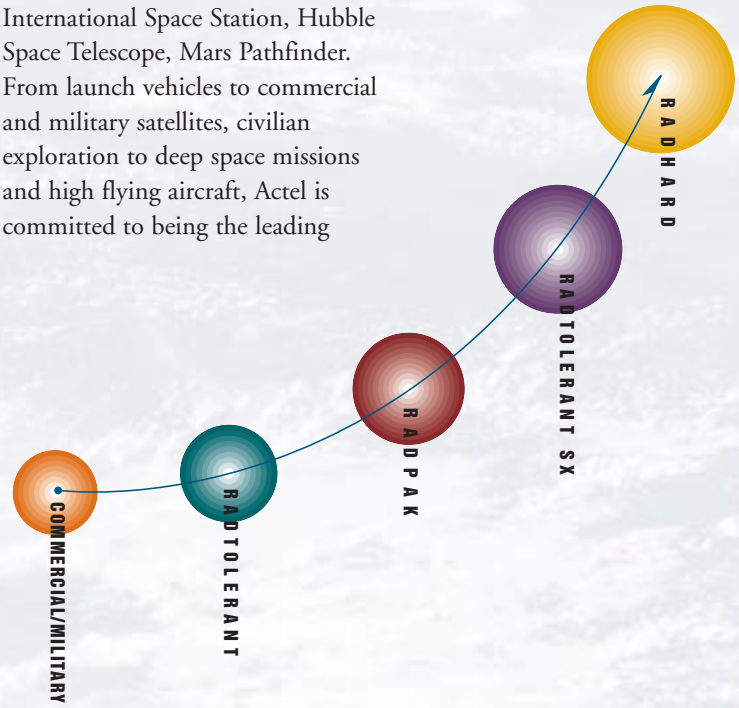
Actel Corporation, the world's largest supplier of aerospace quality FPGAs, is dedicated to providing designers of space applications with products that meet the stringent radiation and quality requirements of the space community. Actel has continued to introduce new devices with improved radiation capability, speed, and density, all while lowering costs. The wide variety of products ensures that every designer of space systems can find an Actel device to meet their digital logic application's requirements.

The Actel Space Heritage

Atlas II, Echostar, SBIRS-High, International Space Station, Hubble Space Telescope, Mars Pathfinder. From launch vehicles to commercial and military satellites, civilian exploration to deep space missions and high flying aircraft, Actel is committed to being the leading supplier of radiation capable devices and is continuously designing, testing, and developing new and improved products for use in space.

Since 1992, Actel has been designed in to subsystems like command and data handling, attitude reference and control, communication payload, and scientific instruments. Since the creation of Actel space-qualified FPGAs six years ago, Actel devices have been on board more than 50 launches and have been accepted for flight-unit applications on over 100 satellites.

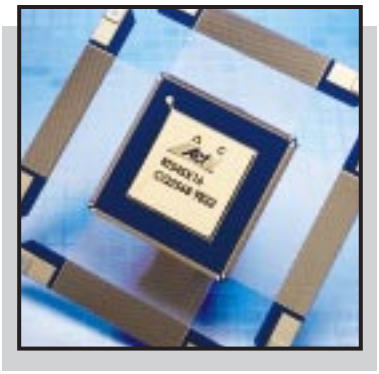
Actel is dedicated to providing space systems designers the necessary tools to get the job done past, present, and future.



Actel

Reliability

1.0µ CMOS FPGA	10.3 FITS
6 Failures, Device Hours @ 55°C = 5.77×10^8 hours	
0.8µ CMOS FPGA	16.6 FITS
1 Failure, Device Hours @ 55°C = 1.21×10^8 hours	
0.6µ CMOS FPGA	5.36 FITS
0 Failure, Device Hours @ 55°C = 1.714×10^8 hours	



International Missions

EnviSat

Cluster II

METOP

Rosetta

Champollion

Stentor

ETS VIII

MTSat

N-Star

ACeS

L-Star

SOHO

SILEX

Integral

Intníl

Space Station

ATV

Poseidon

RadHard FPGAs

Suitable for even the most critical command and data handling functions, RadHard FPGAs are guaranteed to a minimum of 300K rads total dose (Si) to satisfy the rigorous requirements of military and commercial satellite systems and sub-systems.

RadHard devices are manufactured using the radiation hardened processes at Lockheed Martin Federal Systems. They are offered in a space level V/Q flow, combining Class V screening on the shippable units with the cost savings of generic QCI data.

Two RadHard devices are currently available, the RH1020 and RH1280, both guaranteed to 300K rads. An RH54SX16S is also planned, with total dose to 1M rad and high prompt dose survivability.

NEW RadTolerant RT54SX FPGAs

The new RT54SX devices offer the unique combination of total dose radiation performance up to 100K rads, low cost, higher device densities, and high performance. With device performance up to 135 MHz on-chip, support for 3.3V/5V mixed voltage systems, and JTAG boundary scan testability, the RT54SX family delivers the next-generation of space system design support, all from a commercial foundry.

The RT54SX16 is available now and the RT54SX32 will be available soon. Enhanced versions of both are also underway, incorporating 5V drive capability, 3.3V and 5V PCI compliance, and significantly improved SEU immunity.

RAD-PAK® FPGAs

The Actel RAD-PAK devices use a patented high density shielding technology from Space Electronics, Inc. The RP1280A and RP14100A can achieve up to 100K rads total dose survivability depending on environment, inherent system shielding and tested total dose performance of the commercial die lot.

RadTolerant FPGAs

RadTolerant devices can be used in space applications with total dose requirements up to 100K rads.

Five RadTolerant devices are available, the RT1020, RT1280A, RT1425A, RT1460A, and RT14100A. Specific total dose radiation data and reports are available.

Radiation Characteristics of Actel FPG

	Commercial	R
	0-10Krad	
TOTAL DOSE (rads Si)	RT1280A	RT1425 RT1460 RT1410
Process-Dependent		
Design-Dependent		
	<1E-5 (<5LET)	<1
SEU (errors/bit-day LET in MeV-cm2/mg)	RT1280A RT14100A RT1425A RH1280 RT1460A RH1020 S-module1E-6 C-module1E-7	
Latch-Up (LET)		

Pin Compatibility and Commercial Samples

From fully guaranteed RadHard devices to commercial prototypes, Actel offers extensive pin compatibility to address a variety of environmental and economic needs with the same design.

This pin compatibility also allows designs to begin before the final environmental requirements are known. The functionality can then easily be migrated to the appropriate device without a redesign.

Design Tools to Minimize SEU

To further support space system designers, Actel has created design tools to help minimize SEU rates in a design and ensure that design targets are met. This includes support for Triple Modular Redundancy (TMR) in ACTgen and ACTmap and a triple voting circuit in the Actel libraries.

Additionally, design tools from Synopsys and Synplicity support TMR use in designs. And all tools allow block level design so designers can tune SEU for different functions and SEU requirements.

Reliability

All Actel devices deliver reliable and secure performance through our non-volatile antifuse technology. This one-time-programmable element configures the device in a fixed state, eliminating any chance of in-system downloading errors. For over a decade, Actel has been manufacturing devices for high reliability applications with ratings of less than 10 failures-in-time (FITs), corresponding to a useful life of more than 40 years.

Actel Corporation has achieved ISO9002 certification and transitional QML certification and has consistently maintained the highest quality standards for all of our devices. All subcontractors are required to meet stringent requirements prior to acceptance for use on Actel devices. Our relationships with Lockheed Martin Federal Systems and Space Electronics, Inc. further strengthen our ability to offer quality components to the space community.

Pin Compatibility

RadHard	RadTolerant	RAD-PAK	Prototype
RH1020	RT1020		A1020B
RH1280	RT1280A	RP1280A	A1280A
	RT1425A		A1425A
	RT1460A		A1460A
	RT14100A	RP14100A	A14100A
RH54SX16S	RT54SX16/16S		A54SX16
	RT54SX32/32S		A54SX32

As

RadTolerant	RadHard
10-100Krad	300K-1M rad
5A RT1020	RH1020 RH54SX16S
0A RT54SX16/32	RH1280
00A RT54SX16S/32S	
1E-7 (15-20LET)	**<1E-9 (30-80LET)**
A RT54SX16/32	RT54SX16S/32S RH54SX16
R-Cell 1E-7 C-Cell 1E-9	R-Cell 1E-9 C-Cell 1E-10 with TMR: 1E-10
Immunity (No SEL below 80 LET min)	
All RH, RP, and RT devices are considered immune	

Launch Vehicles

Atlas II
SeaLaunch
EELV
Ariane V

Commercial Satellites

Globalstar
FAISat
Intelsat IX
GE-1, 2, 3, 6, 7, 8
Echostar
Telstar
Orbcomm
Orbview
SuperBird

Military Satellites

Mighty Sat
P81 (Classified)
P59 (Classified)
HESSI
Clementine
SBIRS-High
SBIRS-Low
FSED

Device	Speed Grade	Gates	Logic Modules	Available I/Os	DSCC SMD
RadHard					
RH1020-CQ84V	Std	4,000	547	69	5962F90965
RH1280-CQ172V	Std	16,000	1,232	140	5962F92156
RH54SX16S-CQ256V	Std	16,000	1,452	176	Planned
RadTolerant SX					
RT54SX16-CQ208B	Std, -1	16,000	1,452	171	Planned
RT54SX16-CQ256B	Std, -1	16,000	1,452	176	Planned
RT54SX32-CQ208B	Std, -1	32,000	2,880	170	Planned
RT54SX32-CQ256B	Std, -1	32,000	2,880	224	Planned
RT54SX16S-CQ208B	Std, -1	16,000	1,452	171	Planned
RT54SX16S-CQ256B	Std, -1	16,000	1,452	176	Planned
RT54SX32S-CQ208B	Std, -1	32,000	2,880	170	Planned
RT54SX32S-CQ256B	Std, -1	32,000	2,880	224	Planned
RAD-PAK					
RP1280A-CQ172B	Std, -1	16,000	1,232	140	5962-92156
RP14100A-CQ256B	Std, -1	20,000	1,377	228	Planned
RadTolerant					
RT1020-CQ84B	Std	2,000	547	69	Planned
RT1280A-CQ172B	Std, -1	16,000	1,232	140	Planned
RT1425A-CQ132B	Std, -1	5,000	310	100	Planned
RT1460A-CQ196B	Std, -1	12,000	848	168	Planned
RT14100A-CQ256B	Std, -1	20,000	1,377	228	Planned

Civilian/Scientific

Exploration

Deep Space I

Mars Pathfinder

Mars Surveyor

Mars '98

Mars '01, '03, '05

Seawinds

SIRTF

HIRDLS

Lunar Prospector

GALEX

Genesis

TIROS

Landsat VII

EOS-AM1

EOS-PM1

EOS-CHEM1

Cassini

TDRS

Space Shuttle

Hubble Space Telescope

GOES

Mars Climate Orbiter

For more information about Actel's products, call 1.888.99.ACTEL or visit our Web site at http://www.actel.com

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