Solution Brief

SCALE WITH CONFIDENCE USING SPACE-PROVEN LATTICE FPGAs FROM LOW EARTH ORBIT TO DEEP SPACE

Introduction

The new space era demands more from every component on board. From Low Earth Orbit (LEO) to deep space, missions require higher compute performance, greater sensor resolution, and the ability to adapt in flight, all within strict size, weight, power, and cost constraints (SWaP-C). As constellation sizes grow and payloads become increasingly software-defined, satellite designers need a programmable compute solution that is proven, scalable, and ready for the rigors of space today. Lattice space-grade FPGAs deliver exactly that.

The Stakes Have Never Been Higher for Satellite Designers

Modern satellite programs face a convergence of mounting pressures. The shift to Commercial Off-The-Shelf (COTS+) architectures is accelerating innovation, but it introduces new qualification and reliability demands beyond traditional radiation-hardened technology cycles. Growing sensor resolution and expanding constellation sizes are creating onboard data bottlenecks that legacy architectures cannot keep pace with. Very Low Earth Orbit (VLEO) missions face extreme atmospheric drag and stringent power constraints that leave little margin for error. And as payloads become software-defined, systems must support evolving waveforms, security protocols, and multi-orbit interoperability throughout the entire satellite lifecycle, not just at launch.

The Lattice Difference In Space

Lattice space-grade FPGAs give satellite designers a low power, programmable, scalable, radiation-tolerant foundation for both the control plane and data plane. Three generations of radiation-tolerant FPGAs, including flash and SRAM-based products, spanning the FD-SOI-based Lattice Nexus™ platform and the FinFET-based Lattice Avant™ platform, scale from LEO to Geostationary Earth Orbit (GEO) and beyond. Designers can design once and deploy across multiple orbital environments, with footprint compatibility and software reusability that protect their investment. See Table 1 for a comparison of Lattice space-grade products.

The key features of the Lattice space-grade FPGAs include:

- **Low power leadership** and no power sequencing requirements simplify board and thermal design
- **Small form factor devices** anchoring distributed and resilient architectures across the control plane and data plane, including platform supervision, sensor processing, optical communication, signal and image processing, and onboard AI inference
- **Inherent 28 nm FD-SOI radiation tolerance:** soft error rate up to 100X better than bulk CMOS, designed to be latch-up immune by process
- **Built-in hardened scrubber** with memory ECC, plus automated TMR insertion in the Lattice Radiant® design flow

KEY CHALLENGES

- Shifting to COTS+ architectures enables faster innovation beyond traditional radiation-hardened technology cycles
- Growing sensor resolution and constellation sizes are creating onboard data bottlenecks
- VLEO missions face extreme atmospheric drag and stringent power constraints
- Software-defined payloads require support for evolving waveforms, security protocols, and multi-orbit interoperability

LATTICE SOLUTION

- Lattice enables resilient distributed space architectures among the industry's most power-efficient compute solutions
- Three generations of radiation-tolerant FPGAs support scalable control plane and data plane architectures from LEO to deep space
- Low power onboard processing enables sensor fusion, AI inference, and real-time data reduction at the edge
- Reprogrammable FPGA architectures support software-defined payloads, evolving protocols, and mission updates throughout the satellite lifecycle
- Tailored qualification and screening services help meet mission-specific requirements across all orbital environments

- **Proven space heritage** across three generations of radiation-tolerant FPGAs, with TRL9 functions already in flight
- **NASA plastic encapsulated microcircuits (PEM) and European Space Agency (ESA) ECSS-Q-ST-60-13C** qualified and screened products, with radiation lot acceptance testing
- **Rugged flip chip BGA packaging** designed to eliminate tin whiskers and offered in Lattice's smallest available form factors
- **Supply Assurance:** Designed for 20+ year supply longevity
- **Unlimited on-orbit reconfigurability** with multi-boot, background CRC, and determinism during reconfiguration
- **Radiation Test Consortium:** Silicon, IPs, radiation, reliability, tool chains all validated through extensive independent user tests

Table 1: Lattice Space-grade FPGA Product Comparison

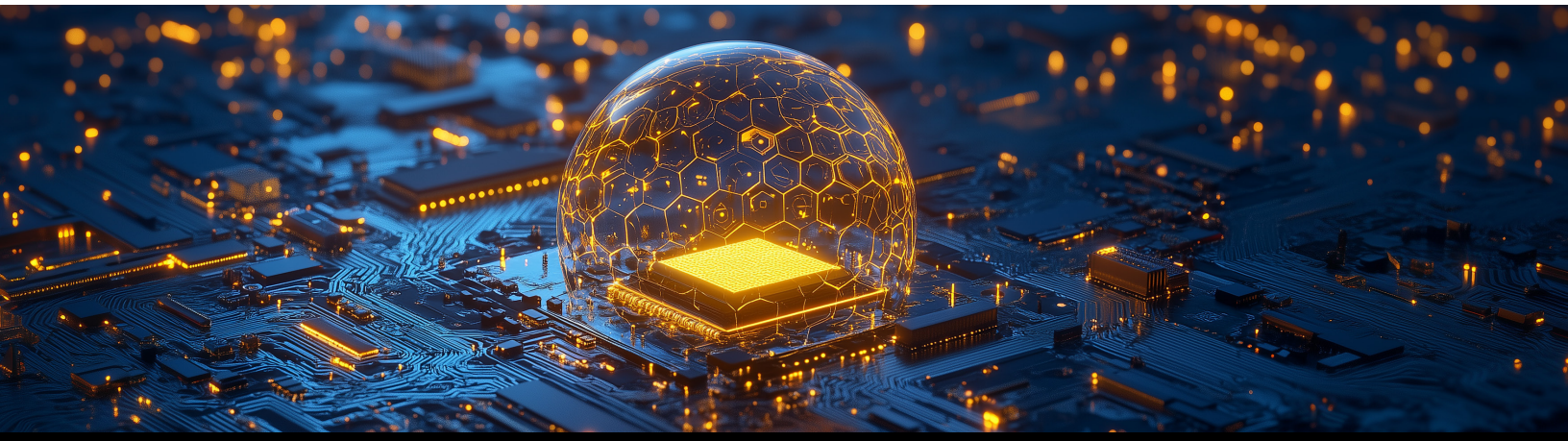
ATTRIBUTE	SPACE ENHANCED	SPACE GRADE*
Device Platform and Family	Lattice Avant, Lattice Nexus, Lattice Certus™-NX, Lattice CertusPro™-NX	Lattice Avant, Lattice Nexus, Lattice Certus-NX, Lattice CertusPro-NX
Package	Leaded (Pb) Packages	Leaded (Pb) Packages
FPGA	Single Lot Date Codes Traceability	Single Lot Date Codes Traceability
Material Control	Single Material / Production Flow	Single Material / Production Flow
Mask Set	Mask Set Control	Mask Set Control
Single Event Benchmark Test	Performed at Initial Qualification	Performed at Initial Qualification
Radiation Lot Acceptance	Benchmark Radiation Results	RLAT at 100 krad(Si)
Assurance	20+ Year Supply Longevity	20+ Year Supply Longevity
Temperature	A-temp (-40 °C to +125 °C Tj)	A-temp (−40 °C to +125 °C Tj) and an optional extended temperature range
Lot Level Temperature Cycle	No	Yes
Outgassing per ASTM E595	No	Yes
Data Reports	Benchmark Radiation Test	RLAT, NASA PEM and ECSS-13C Qualification, Electrical test, Outgassing, CoC

*Footprint compatible with commercial devices. Deploys the same commercial silicon mask set.

Conclusion

Lattice FPGAs provide satellite designers with the power efficiency, compact form factor, and proven reliability required to accelerate development and reduce mission risk. The scalable portfolio of inherently radiation-tolerant FPGAs, spanning the Lattice Nexus platform and the Lattice Avant platform, offers the flexibility to select the appropriate solution for specific mission requirements, from small commercial satellites to demanding government programs.

Every Lattice FPGA product family and platform within the space portfolio has been independently verified by agencies in the United States and Europe, so customers can confidently deploy systems that meet the performance, reliability, and lifecycle demands of space operations. Through the open Radiation Test Consortium, Lattice collaborates with developers and industry experts to accelerate test platform development and provide transparent access to test results, giving engineering teams the data they need to make informed design decisions with greater speed and certainty.



Ready to Learn More?

To learn more about Lattice low power FPGA-based solutions for aerospace and defense applications, visit **www.latticesemi.com** or contact us at **sales@latticesemi.com**.