

## **Radiation Hardened Electronics - Market Share Analysis, Industry Trends & Statistics, Growth Forecasts 2019-2029**

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### **Report description:**

The Radiation-Hardened Electronics Market is valued at USD 1.81 billion in 2024 and is expected to reach USD 2.18 billion by 2029, registering a CAGR of 3.87% during the forecast period.

Radiation-hardened electronics are used for Intelligence, surveillance, and reconnaissance (ISR) systems, as they are built to survive extreme radiation exposures. The rise in demand for security measures such as monitoring, information collection, and border control is going to fuel the demand for rder control is driving the need for these specialized electronics. In high radiation environments, proper power management is crucial for radiation-hardened materials, as any electronic damage can pose safety hazards. Thus, reliable radiation-hardened power management systems are essential in such facilities.

-The space industry extensively employs radiation-hardened electronics, contributing significantly to the market's growth. For example, in 2022, the global space economy generated USD 384 billion in revenue, according to the Satellite Industry Association. Additionally, as of 2022, approximately 7,316 active satellites were orbiting the Earth, marking a 51% increase from the previous year and a 321% increase over the past five years.

-Satellites in orbit face substantial exposure to highly energetic charged particles and electromagnetic radiation unique to the space environment. The radiation levels they encounter depend on their distance from Earth; satellites in low earth orbit, situated within the thermosphere, are more exposed to UV radiation, potentially impacting the molecular composition of electronic materials.

-Inside nuclear power plants, electrical and electronic systems are subjected to high-energy radiation that can severely affect their functionality and overall safety. Ionizing radiation within these plants creates electron-hole pairs, altering transistor parameters and potentially causing their destruction. Additionally, this radiation can induce leakage currents between circuits. Therefore, installing radiation-hardened electrical/electronic systems with proper shielding is critical for system designers, a key factor driving market growth.

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- Despite increasing demand for radiation-hardened electronic components across various industries, the market faces challenges due to higher design and development costs. Specific design considerations are necessary to create electronics that can withstand harsh operating conditions, contributing to increased development costs. Furthermore, stringent testing is essential to ensure product reliability, further elevating the cost of radiation-hardened electronics.
- The COVID-19 outbreak significantly impacted the market due to supply chain disruptions and restrictions on manual workforce use, affecting the electronics/semiconductor industry's operations. This led to an escalation of the chip shortage issue. However, with COVID-19 restrictions lifted and major end-user industries returning to full-capacity operations, the market is experiencing gradual demand growth.

## Radiation Hardened Electronics Market Trends

### Nuclear Power Plants to Witness Significant Growth

- The demand for radiation-hardened electronics within nuclear power plants is on the rise as facility managers increasingly deploy these specialized components to enhance signal integrity, bolster the safety and efficiency of nuclear reactors, and mitigate radiation-induced degradation of plant equipment.
- The integration of radiation-hardened (rad-hard) electronics has proven instrumental in nuclear sensing and instrumentation. Placing advanced sensors and associated electronics closer to reactor cores holds promise for optimizing reactor control and operation by ensuring heightened signal accuracy, precision, and fidelity. This advancement translates into safer and more efficient energy production processes.
- Given the extensive reliance on electronic systems within nuclear facilities, there's a crucial need for devices capable of withstanding substantial radiation exposure. Wireless monitoring in nuclear power plants, facilitated by radiation-hardened electronics, is paramount. These electronics also serve a critical role in surveying nuclear power plants, especially in scenarios where communication infrastructure fails during critical post-accident situations or in areas with exceedingly high radiation fields.
- The number of operational nuclear reactors worldwide is expected to maintain a significant presence in the foreseeable future, driven by increasing investments in developing regions. For instance, data from the World Nuclear Association, EIA, and the International Atomic Energy Agency (IAEA) indicated 411 operational nuclear reactors globally in 2022, a figure that surged to 436 by May 2023. Consequently, the continued investments in nuclear power plants are poised to fuel opportunities within the studied market.
- Electromagnetic and thermal radiation represent common occurrences in electricity generation and distribution infrastructures, heightening the susceptibility of general electronic components to malfunction. Consequently, the anticipated growth in the adoption of radiation-hardened electronics during the forecast period is driven by the imperative to ensure robust performance under such demanding conditions.
- Beyond nuclear power plants, the adoption of nuclear energy generation technology is expanding into various sectors, including nuclear submarines. The emergence of several new nuclear-powered submarine projects in recent years is expected to sustain and drive further opportunities within the studied market.

### Asia Pacific is Expected to Witness Significant Growth

- Due to a growing number of commercial space projects, the market for radiation-hardened electronic components is driving market growth in the Asia Pacific region. In recent years, China has made significant progress in developing several aerospace core integrated circuits, including FPGA and CPU, which major aerospace projects like human spaceflight and moon exploration have utilized.

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- Adhering to the above synopsis, China revealed that the country's space science and technology activities will significantly boost in 2023, including big-ticket missions like the Tianzhou-6 cargo craft, the Shenzhou-16 and the Shenzhou-17 flight missions to solidify its Tiangong space station activities further. The corporation will also take steps to speed up the construction of a new generation of commercial remote monitoring satellites this year and launch these missions. Meanwhile, the BeiDou-3 Navigation Satellite System will witness the launch of three backup satellites.
- China will continue developing and researching radiation-hardened technologies in 2023. It has undertaken to increase the local production of radiation-hardened chips. Space equipment could enable itself to perform all advanced analytics, such as image recognition, picture classification, automated decisions, and timely actions, by incorporating AI/ML functionality in conjunction with radiation-hardened chips on board.
- Moreover, the flourishing semiconductor industry in the region is another factor contributing to market growth. China is trying to indigenize the military and defense sector to promote its competitiveness and technology innovation, further strengthening the military and mitigating risks related to foreign dependence. There is an obvious importance of semiconductors for domestic security.
- China's emphasis on the relationship between security and microelectronics is predicated on four arguments: a strong chip industry will help modernize the PLA and enhance its ability to conduct conventional warfare; the PLA can wage information warfare (IW) by exploiting home-grown advanced semiconductor technologies that enhance its ability to wage unconventional war; as regards defensive IW, a robust indigenous industry can mitigate the risks of dependence on unreliable foreign supplies of critical semiconductors; and China recognizes semiconductors' dual-use nature and the trend of spin-on in its policy of using commercial off-the-shelf (COTS) items in military systems to integrate its rising commercial chip industrial base into its military counterpart.
- Furthermore, it is possible to manufacture radiation-hardened electronics that can endure high temperatures and radiation levels found in nuclear reactors, which have a favorable impact on their total sales. According to the World Nuclear Association, in 2022, Asia accounted for 39 units in the number of reactors under construction worldwide. India's total nuclear power capacity reached about 6.8 gigawatts of electricity from 2021 to 2023.

#### Radiation Hardened Electronics Industry Overview

The radiation-hardened electronics market showcases fragmentation with major players like Honeywell International Inc., BAE Systems PLC, Texas Instruments, Data Device Corporation, and Frontgrade Technologies. These entities employ strategies such as partnerships and acquisitions to fortify their product portfolios and establish enduring competitive edges.

In August 2023, Frontgrade Technologies finalized its acquisition of Aethercomm, a company specializing in high-power radio frequency (RF) solid-state power amplifiers, transmit/receive modules, and high-power RF switches. This acquisition positions Frontgrade Technologies to offer a comprehensive, integrated, and turnkey solution tailored for aerospace and defense clientele.

Another notable collaboration occurred in February 2023 between Texas Instruments and Teledyne e2v, focusing on a novel radiation-tolerant DDR4 modular platform. This initiative aims to assist satellite OEMs in optimizing their system development process by reducing time and engineering efforts. The hardware comprises a field-proven 4GB/8GB capacity DDR4T0xG72 DDR4 memory module from Teledyne e2v, complemented by a TI TPS7H3301-SP DDR termination low drop-out (LDO) voltage regulator, ensuring a stable supply for the DDR4 module.

#### Additional Benefits:

- The market estimate (ME) sheet in Excel format
- 3 months of analyst support

#### Table of Contents:

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## 1 INTRODUCTION

### 1.1 Study Assumptions and Market Definition

### 1.2 Scope of the Study

## 2 RESEARCH METHODOLOGY

## 3 EXECUTIVE SUMMARY

## 4 MARKET INSIGHTS

### 4.1 Market Overview

### 4.2 Industry Attractiveness - Porter's Five Forces Analysis

#### 4.2.1 Bargaining Power of Suppliers

#### 4.2.2 Bargaining Power of Buyers

#### 4.2.3 Threat of New Entrants

#### 4.2.4 Threat of Substitute Products

#### 4.2.5 Degree of Competition

### 4.3 Raw Material Analysis for Radiation-Hardened Components

## 5 MARKET DYNAMICS

### 5.1 Market Drivers

#### 5.1.1 Increasing Instances of Satellite Launches and Space Exploration Activities

#### 5.1.2 Growing Adoption of Radiation Hardened Electronics in Power Management and Nuclear Environment

### 5.2 Market Challenges/Restraints

#### 5.2.1 High Designing and Development Cost

## 6 MARKET SEGMENTATION

### 6.1 By End-user

#### 6.1.1 Space

#### 6.1.2 Aerospace and Defense

#### 6.1.3 Nuclear Power Plants

### 6.2 By Component

#### 6.2.1 Discrete

#### 6.2.2 Sensors

#### 6.2.3 Integrated Circuit

#### 6.2.4 Microcontrollers and Microprocessors

#### 6.2.5 Memory

### 6.3 By Geography

#### 6.3.1 Americas

#### 6.3.2 Europe

#### 6.3.3 Asia-Pacific

#### 6.3.4 Rest of the World

## 7 COMPETITIVE LANDSCAPE

### 7.1 Vendor Ranking Analysis

### 7.2 Company Profiles\*

#### 7.2.1 Honeywell International Inc.

#### 7.2.2 BAE Systems PLC

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- 7.2.3 Texas Instruments
- 7.2.4 Data Device Corporation
- 7.2.5 Frontgrade Technologies
- 7.2.6 STMicroelectronics International NV
- 7.2.7 Infineon Technologies AG
- 7.2.8 Microchip Technology Inc.
- 7.2.9 Micropac Industries Inc.
- 7.2.10 Renesas Electronic Corporation
- 7.2.11 Solid State Devices Inc.
- 7.2.12 Advanced Micro Devices, Inc.
- 7.2.13 Everspin Technologies Inc.
- 7.2.14 Vorago Technologies

## 8 MARKET OPPORTUNITIES AND FUTURE TRENDS

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