

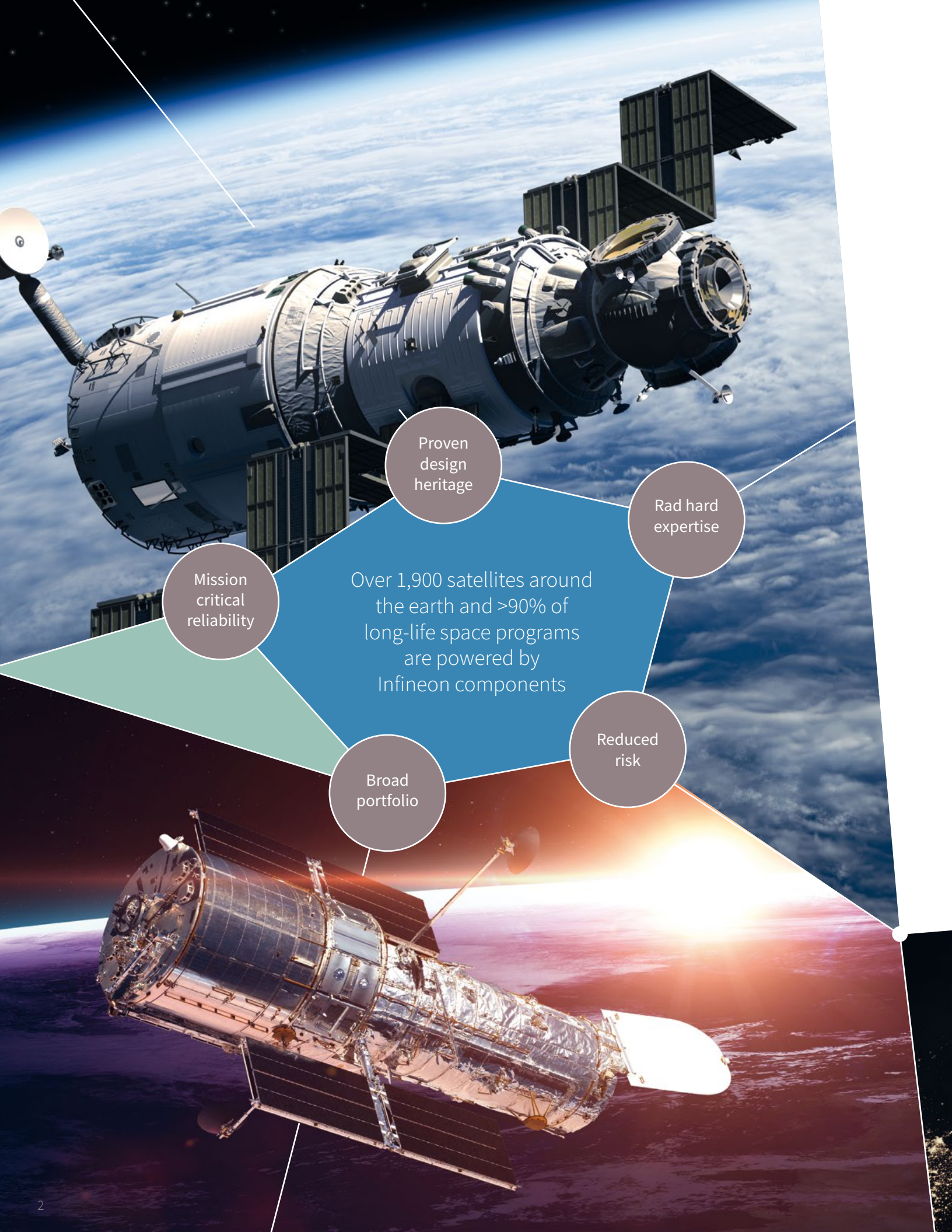


We power space

Space power management solutions

www.infineon.com/hirel





Proven
design
heritage

Rad hard
expertise

Mission
critical
reliability

Over 1,900 satellites around
the earth and >90% of
long-life space programs
are powered by
Infineon components

Reduced
risk

Broad
portfolio

Trusted source for space power solutions

Infineon Technologies and its subsidiary, International Rectifier HiRel Products, Inc. (IR HiRel), is a leader in high reliability, radiation-hardened (rad hard) power conversion for space flight applications, from space exploration to national security programs and more.

Our design, operations and quality systems exceed military standards. Infineon offers standard and custom semiconductor-based products specifically designed for space applications where commercial electronics cannot meet the requirements.

Applications include bus platforms and payloads for planetary exploration vehicles, satellites, classified missions and similar programs where failure-free performance is required in severe mechanical, thermal and radiation environments.

Infineon's specialized team of experts provides proven, high performance and fully documented products to expedite approval paths with management and end customers.

Satellite bus & payload types

- › Bus platform subsystems
 - Attitude & orbit control (AOCS)
 - Command & data handling (CD&H)
 - Communications & antennas
 - Electrical power
 - Propulsion
 - Thermal control
- › Payloads
 - Telecom
 - Navigation
 - Government
 - Remote sensing
 - Scientific

Thousands of programs, decades in space

Infineon has a long history serving the space industry. We understand the engineering and manufacturing requirements and challenges of designing for reliable performance in the extreme thermal, mechanical and radiation environments of space. For decades, customers have relied on our rad hard power solutions in thousands of mission-critical space, aerospace and national security programs. Many of these spacecraft are still in flight today.

Infineon combines its world-class heritage with deep technical expertise and product innovation to deliver benchmark power solutions for customers. Our rad hard power management portfolio is recognized globally for its excellent performance, reliability, longevity and unparalleled design heritage.





Continuous innovation

Infineon continues to invest and develop next-generation rad hard technologies that maintain the rigorous performance standards required in space. Our advances in rad hard silicon platforms, packaging and die sizes help improve size, performance and efficiency, while preserving the quality and reliability levels our customers need.

Continuous development and upgrade of proven DC-DC converter platforms improves end-of-life performance with advanced electrical features and solid radiation performance. Infineon addresses component obsolescence and maintains our proven IR HiRel DC-DC product line with integration of suitable off-the shelf, validated components with improvements when the opportunity exists.

Radiation hardness assurance (RHA)

Infineon's rad hard MOSFETs are tested to verify their radiation hardness capability, with an assurance program based on the requirements outlined in ESCC-5000, MIL-PRF-19500 and associated slash sheets. Our IR HiRel-branded products exceed the standard requirements with a sampling size up to two times greater than is required for every manufacturing lot. Both pre- and post-irradiation performance are tested and specified using the same drive circuitry and test conditions in order to provide a direct comparison. Radiation harden by design techniques virtually eliminate the possibility of SEGR and SEB in the rad hard power MOSFETs. Robust performance is then verified through extensive single event effects testing.

IR HiRel DC-DC converters use proven, radiation harden by design methodology based on a vast library of radiation tolerant and established reliability components controlled by our internal specifications. Both our PCB and hybrid designs are validated through analyses such as stress, thermal and worst case analyses which covers manufacturing tolerance, application load range, aging and radiation effects, per MIL-PRF-38534 Class K for hybrid products. Our converters can be used with confidence as is in most space missions without any additional de-rating.



Quality conformance inspection

Unlike standard commercial products, Infineon and IR HiRel products undergo various levels of quality conformance inspection (QCI) to ensure that the products are capable of performing to specifications in the application's harshest environments. Our program supports a breadth of screening and QCI levels in accordance with specified quality levels. Additional testing eliminates nonconforming parts, increasing confidence in the reliability of long-lasting, high performance specification compliance.

Infineon

- › ESCC-5000 for discrete semiconductors, hermetically sealed and die

IR HiRel

- › MIL-PRF-19500 and MIL-STD-750 for discrete MOSFET and diode semiconductors manufactured to JANTXV or JANS level
- › MIL-PRF-38534 and MIL-STD-883 for DC-DC converters, filters, solid-state relays (SSR) and power hybrids manufactured to class H or class K level
- › MIL-PRF-38535 and MIL-STD-883 for ICs and voltage regulators manufactured to class B or class S level Source Control Drawing (SCD)

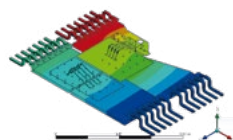
Flexible custom capabilities

Infineon's expert design team regularly works with customers to semi-customize or develop fully custom products to address complex, specific requirements and applications. Created in partnership with customers, our IR HiRel custom designed products are engineered for optimal integration with host equipment, reducing development effort and risk.

Services include turnkey design-to-specification and hybrid power modules and circuit card assemblies to deliver products that fit perfectly to the application in compact, reliable packages. We follow a gated product development process that provides all necessary analyses and documentation, verification and validation to ensure smooth release to manufacturing and successful qualification.



Specification review
and development plan



Design, analysis
and verification



Process engineering
and design validation

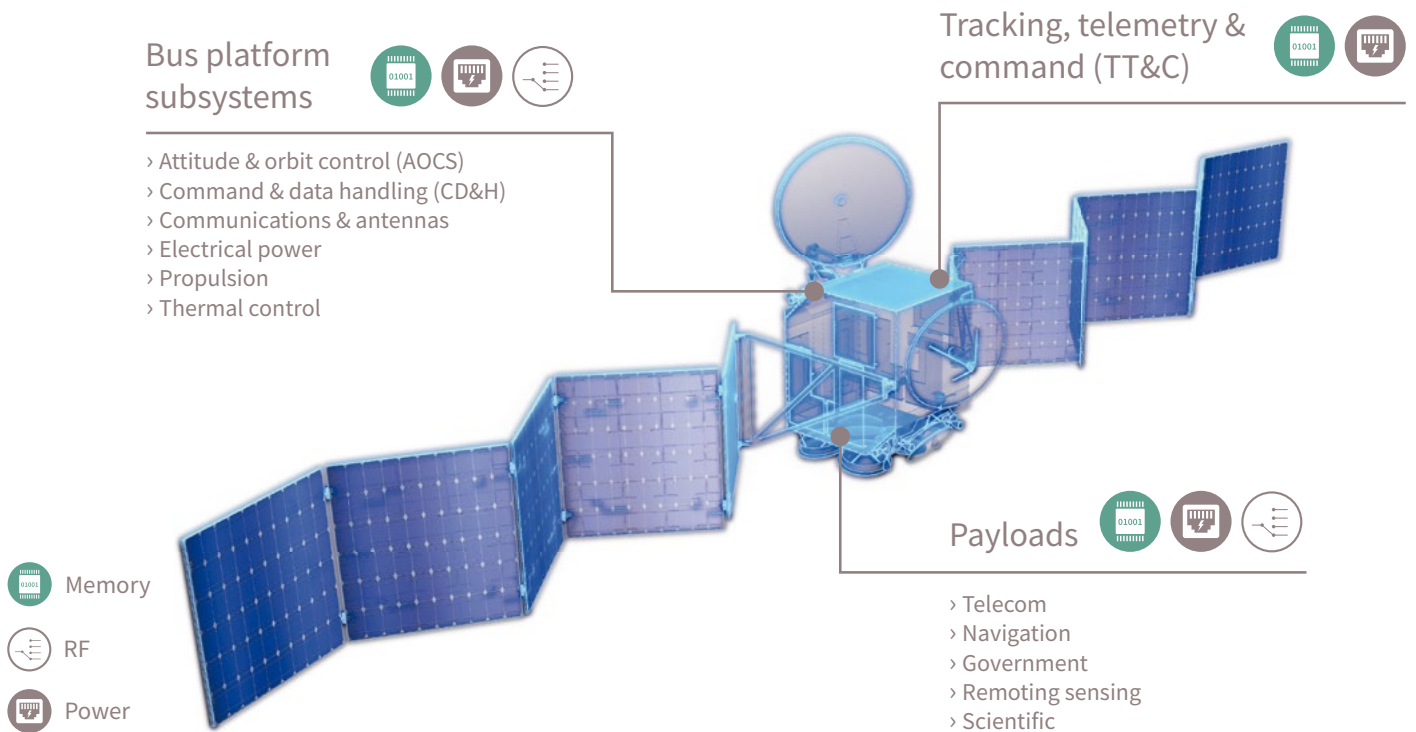


Manufacturability
readiness and qualification

Space power solutions portfolio

Infineon's rad hard power management portfolio for space is the industry's broadest, spanning from component level with rad hard MOSFETs via hybrid-based DC-DC converters and open frame PCB-based DC-DC converters to complete system level power supplies. Combining decades of experience

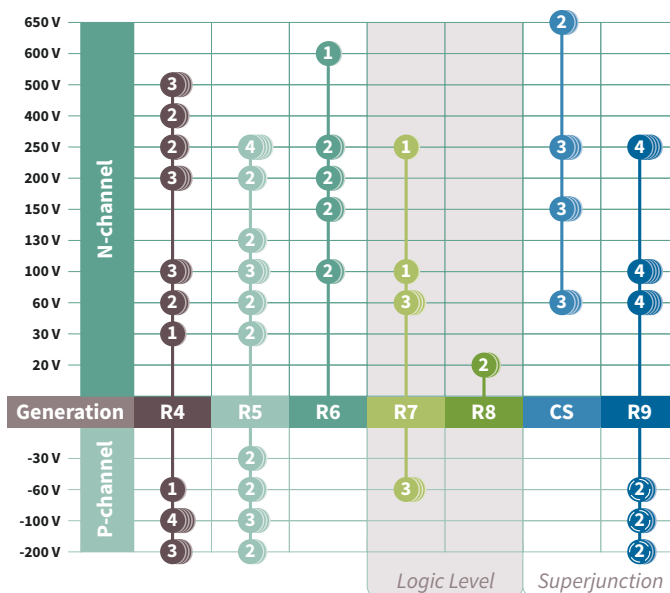
and a unique diversity of expertise and talents, Infineon is the ideal partner for tailoring power solutions to individual customer needs, from minor modifications to full-custom solutions.



Rad hard MOSFETs

Infineon is a renowned leader in high-reliability power solutions, with our subsidiary, IR HiRel, being the first manufacturer to offer rad hard power MOSFETs for space in 1987. Over the last three decades, IR HiRel has continuously innovated in silicon design, packaging technology and quality with US DLA QPL products up to MIL-PRF-19500 JANS level.

Infineon offers a broad selection of N-channel and P-channel rad hard MOSFETs in a wide range of hermetic packaging options screened to MIL-PRF-19500 and ESCC-5000, and available as QPLs. Select rad hard MOSFETs are also available as bare die.



N-channel: 20 V to 650 V
P-channel: -30 V to -200 V

R9	Improved SWaP over prior rad hard MOSFET generations
CS	License-free, based on Infineon CoolMOS™ technology
R8	Designed for low voltage POL designs
R7	Designed for logic level gate drives
R6	Best performance for mid to high-voltage designs
R5	Optimized performance for low to mid-voltage designs
R4	All purpose MOSFET, legacy design with extensive space heritage

Die sizes available

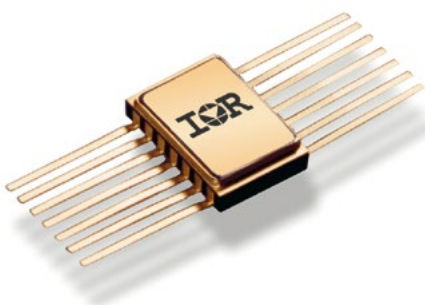


SupIR-SMD™
 Better than SMD-2 on carrier,
 37% smaller and 45% lighter



SMD-0.5e
 Improved design
 Direct-to-PCB mounting

Rad hard gate drivers



Engineered to match our rad hard MOSFETs for maximum performance, IR HiRel's space-grade high-side and low-side MOSFET drivers are rated at 100 krad(Si) for TID and have been characterized for SEE. These gate drivers feature a wide operating supply range up to 20 V, low propagation delay and high drive currents. Increase reliability and reduce solution size and weight by replacing bulky magnetic or opto-coupler based gate driver designs with IR HiRel's space-grade gate drivers.



Space-grade DC-DC converters

IR HiRel's broad portfolio and implementation technologies allow customers to optimize their systems around different key performance parameters such as:

- › Size and mass
- › Feature set
- › Power conversion efficiency
- › Flexibility for input and output voltages
- › Use of standard qualified parts
- › EMI performance
- › System requirements like redundancy and TM/TC interfaces

The power solutions are offered through a large portfolio of space-level rad hard hermetic, hybrid DC-DC converters and PCB open frame and enclosed power supplies, from a few watts to hundreds of watts, with options for parallel operation and redundant systems.



M3GB series

Hermetic hybrid DC-DC converters

- › Over 500 years of engineering hybrid converters expertise
- › General purpose, application-specific and customized DC-DC converters, including MIL-STD-461 filters
- › Qualified to MIL-PRF-38534 Class K, many available as Standard Microcircuit Drawings
- › Standard and advanced functionality and protections
- › License-free exportable (EAR99) rad hard products
- › DLA approved Radiation Hardness Assurance (RHA) plan
- › All components fully de-rated up to full output power level
- › Immunity to total ionizing dose (TID), single event effects (SEE), neutron and prompt dose radiation environments
- › End-of-life performance verification with supporting design analyses for use as is, with no additional de-rating in most applications
- › Mission specific radiation environment testing and analysis



PCB open frame and enclosed power supplies

- › Application-specific power converters with matching customer requirements for individual output regulation, and features for redundant operation and output protection
- › A key application segment is EPC for RF with output sequencing, in-orbit output voltage adjustments, very high conducted susceptibility rejection and low output noise
- › Advanced topology and magnetic design enable industry's best power conversion efficiency, especially for the 'low voltage, high current' segment
- › Generic design practices allow modification to different power buses and program requirements with minimal engineering effort, and short lead time without undue risk

Backed by IR HiRel's vast space heritage, customers can source high-reliability, qualified products that reduce project risk and time to market. Our flight-proven DC-DC converters are easy to design in and can be used as is with confidence in a wide range of applications, with no de-rating or additional circuitry.



IR HiRel delivers a range of products based on standard platforms and general design philosophy which can be tailored to the customer's program requirements and compliant to customer Source Control Drawing (SCD). Fully customized designs are also supported. All models and variants can be supplied with full data analysis package.

Solid state relays

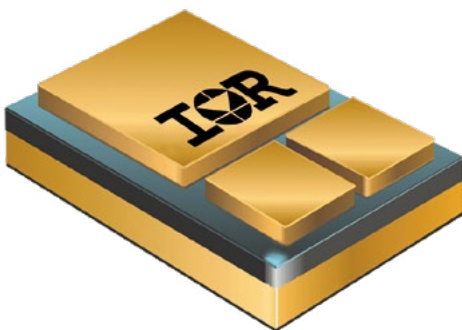
IR HiRel's solid state relay (SSR) portfolio includes rad hard single, dual and octal devices in hermetically sealed packages and tested up to 100 krad(Si) total ionizing dose. The family includes optically coupled, buffered and non-buffered solid state relays, with input and output MOSFETs using IR HiRel's industry-leading rad hard MOSFET technology. Choose our SSRs for high-reliability applications including solar array management, heater controls, bus switching, and ground power isolation. In addition to our standard SSRs, IR HiRel also offers custom space-grade power control modules designed to customers' specifications.



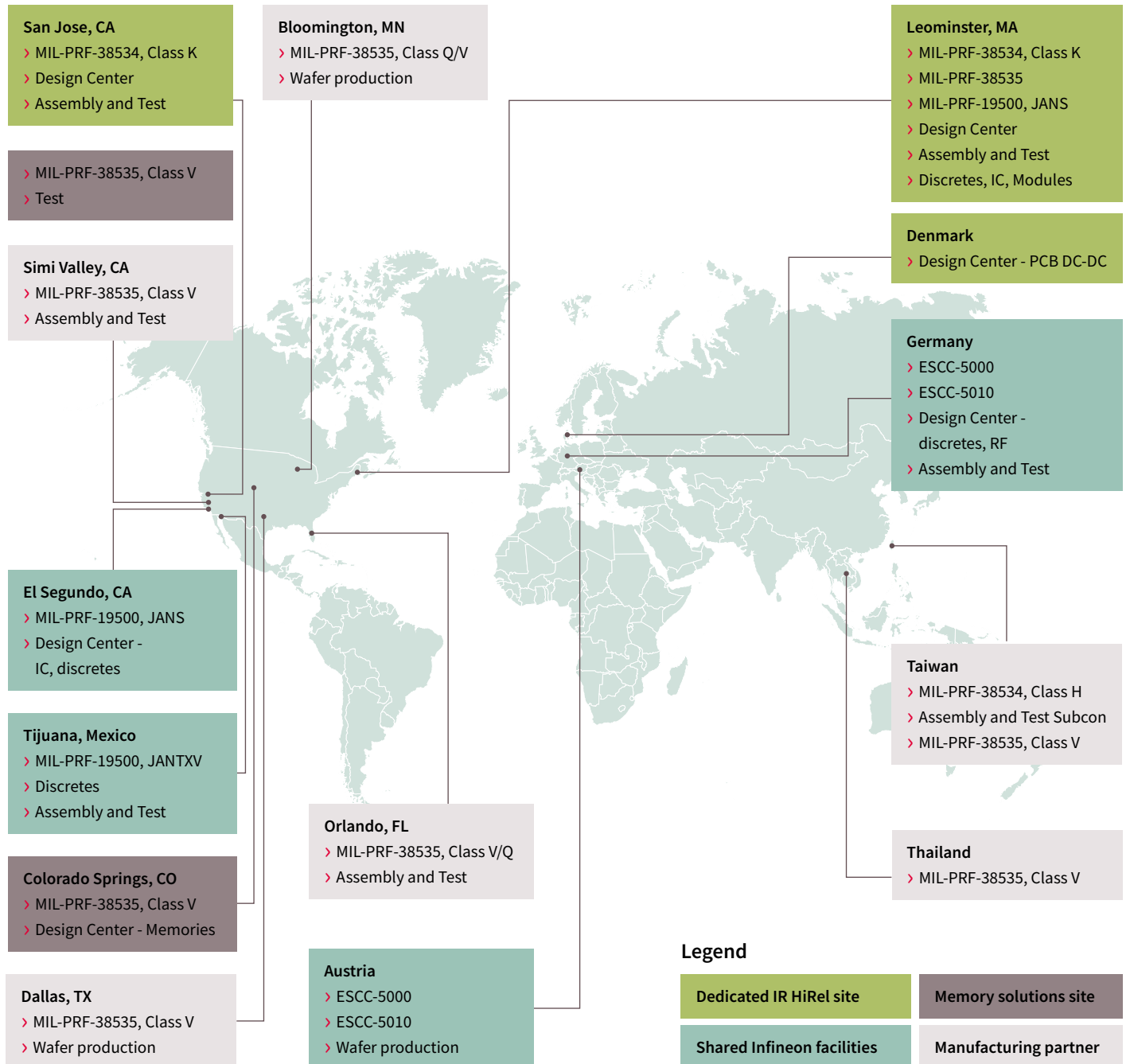
Schottkys & rectifiers

IR HiRel's portfolio includes high-reliability, hermetically packaged Schottky and ultra-fast rectifiers. Offered in variety of voltages and industry standard surface mount and through-hole packages, our Schottky and ultra-fast rectifiers are available in single, common cathode, common anode

and double configurations. Schottky quality screening levels include MIL-PRF-19500 JANTX, JANTXV and JANS, with US DoD DLA QPLs also available. The ultrafast rectifiers are screened to MIL-PRF-19500 equivalent.



HiRel locations and certified sites



A world leader in rad hard power solutions

Infineon offers a broad selection of solutions certified to ESA and DLA standards for our global customers. We focus on the quality and reliability of our space-grade power conversion

solutions, reducing development effort and risk, so that our customers can meet requirements faster and work smarter.

Where to buy

Infineon distribution partners and sales offices:

www.infineon.com/WhereToBuy

Service hotline

Infineon offers its toll-free 0800/4001 service hotline as one central number, available 24/7 in English, Mandarin and German.

- › Germany 0800 951 951 951 (German/English)
- › China, mainland 4001 200 951 (Mandarin/English)
- › India 000 800 4402 951 (English)
- › USA 1-866 951 9519 (English/German)
- › Other countries 00* 800 951 951 951 (English/German)
- › Direct access +49 89 234-0 (interconnection fee, German/English)

* Please note: Some countries may require you to dial a code other than "00" to access this international number.
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Published by
Infineon Technologies AG
Am Campeon 1-15, 85579 Neubiberg
Germany

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Document number: B119-I1090-V3-7600-EU-EC-P
Date: 03/2022

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For further information on technologies, our products, the application of our products, delivery terms and conditions and/or prices please contact your nearest Infineon Technologies office (www.infineon.com).

Warnings

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies Office.

Infineon Technologies Components may only be used in life-support devices or systems with the expressed written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system.

Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.