Rad hard isolated DC-DC converters

Power space missions with confidence

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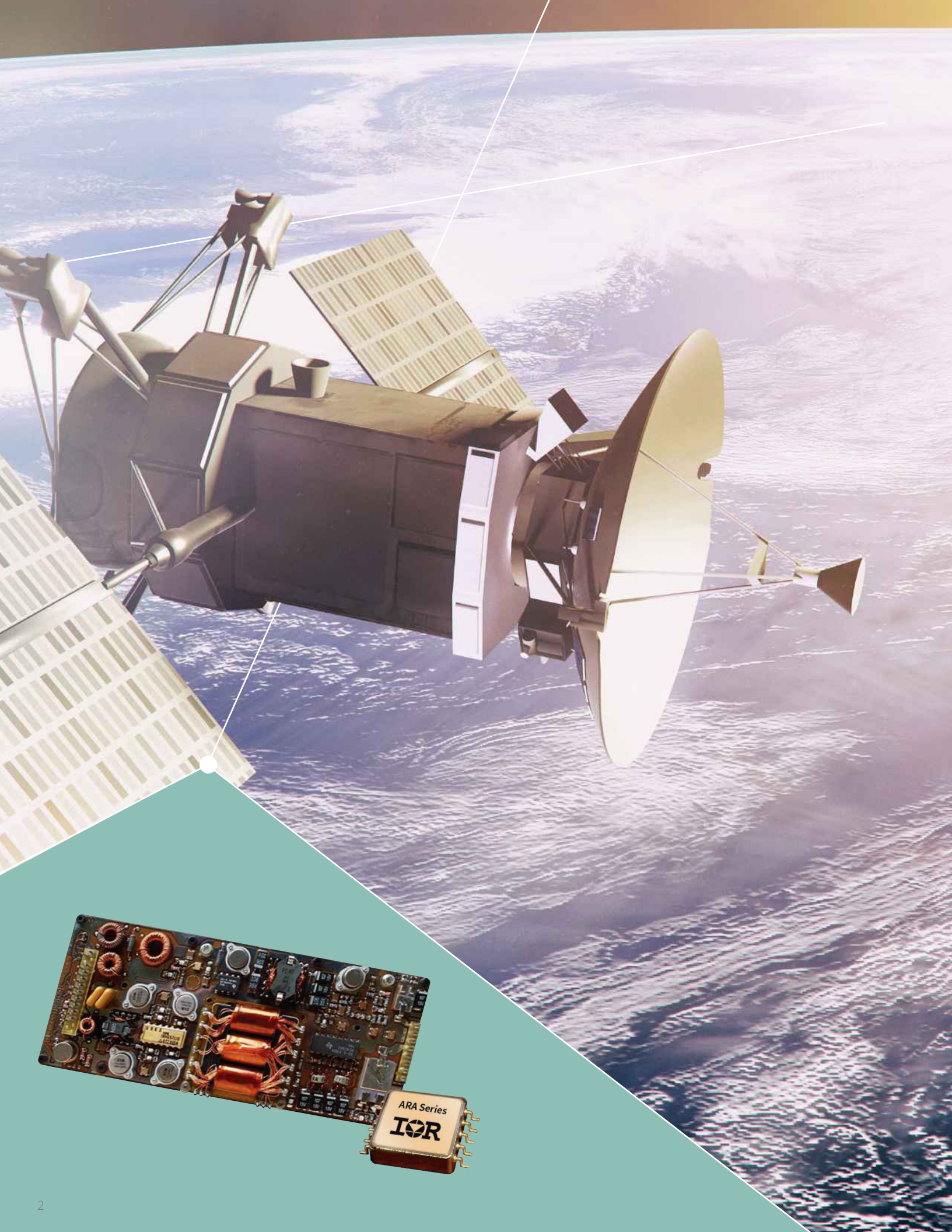
IR HiRel
An Infineon Technologies Company

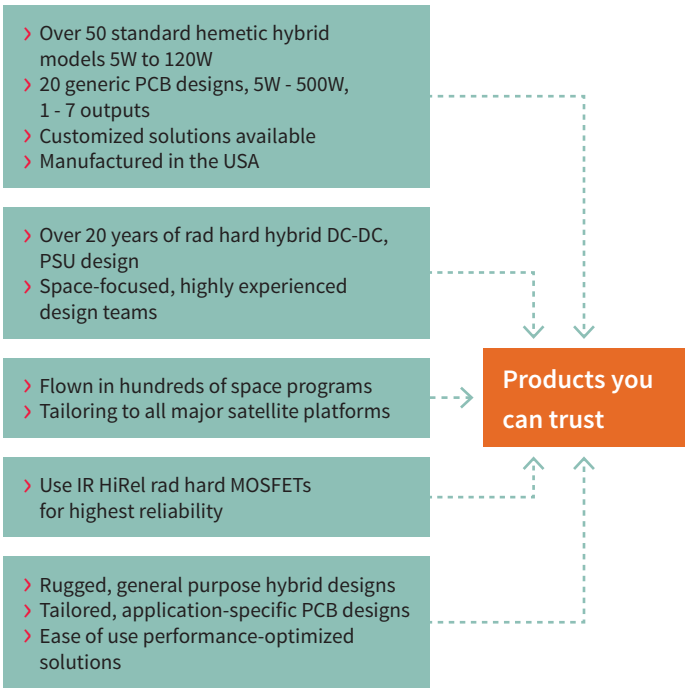

ARA Series
IOR

IR HiRel is a trusted expert in high-reliability, radiation-hardened DC-DC converters, with a large portfolio of standard and customized rad hard hermetic, hybrid DC-DC converters and PCB open frame and enclosed power supplies. We offer DC-DC converters designed specifically for space applications with all standard and customized documentation to demonstrate product compliance to program requirements. From a few watts to hundreds of watts, IR HiRel offers power solutions you can count on, based on a broad space program heritage and with ease of use in mind.

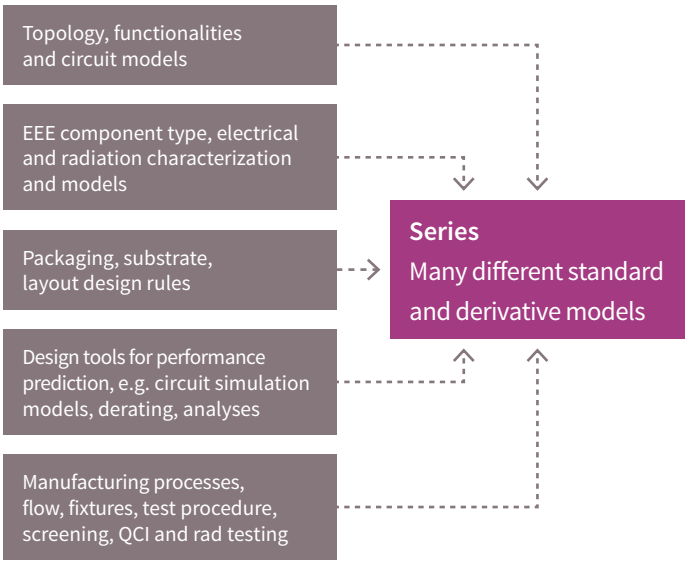
Flexible solutions based on specific applications needs

IR HiRel's standard DC-DC converter portfolio broadly covers power conversion needs for space applications. The offering includes both hermetic hybrid technology and PCB-based designs in open frame or fully enclosed, enabling high current capabilities and minimal form factors.

With a broad feature set, IR HiRel can readily tailor options to specific customer needs with standard platforms.



Designed for the ultimate in reliability



Verification-based development approach yielding confidence in many product derivatives

Common platform rad hard by design approach for the ultimate in reliability

IR HiRel uses a proven, conservative design methodology for its hybrid and PCB DC-DC converters that includes careful characterization and selection of components, such as our rad hard MOSFETs, and circuits adapted to be immune to radiation environments and de-rated to MIL-STD-1547 and MIL-STD-975 requirements. The designs go through strict verification with extensive design analysis done using simulation models validate with extensive measurements.

IR HiRel has developed innovative rugged packaging using advanced materials and uses design rules to ensure reliable manufacturing and performance of the product. Each manufacturing process is carefully qualified and reused across product families to reduce risk. Platforms undergo thorough testing including QCI and TID and SEE radiation testing.

Reuse of proven design platforms reduces qualification requirements and affords access to multiple variants with standard output voltages, including customized models, with reduced engineering effort and leveraging proven manufacturing processes. IR HiRel customers benefit from the platforms' rich space heritage, with models offered as SMD-qualified or IR space-grade.

Features and functionalities

Typical manufacturing testing and documentation available

- Lot traveler
- Declared component list
- Element evaluation data
- Configuration control
- Screening test data
- Lot specific Group C (hybrids)
- Lot specific DPA (hybrids)
- Source inspection
- First article report

Engineering services

- Program management
- Requirement reviews
- Derivative and custom design
- Preliminary and critical design reviews
- Manufacturing and test readiness review
- Custom element evaluation such as TOR and radiation lot acceptance (hybrids)
- Program specific design and data analyses
- First article test
- Electrical characterization and EMI testing
- Model and lot specific radiation testing

Common to both hybrids & PCBs

- Rad tolerant and rad hard designs up to 200 krad and 82 MeV.cm²/mg LET
- Full design analyses
- SCD controlled EEE parts
- Rad hard JANS MOSFETs
- Magnetically coupled feedback

General features (line-specific)

Hybrid DC-DC	PCB PSU
Overload and short-circuit protection and no-load operation	Output overload and short-circuit protection and no-load operation
MIL-PRF-38534 Class K SMD with RHA,	Integrated EMI input filter
TOR capability (select models)	Input UVLO (latching or auto re-start configurable)
Wide input voltage range	Individual regulation on all outputs
Single and dual outputs	Single and multiple outputs
UVLO	
External inhibit	
Adjustable output voltage	
Rugged design for a variety of applications	

Other features (series-dependent)

Hybrid DC-DC	PCB PSU
Remote sense	Remote sense
Frequency synchronization	Frequency synchronization
Output OVP (single-point failure free)	Output OVP (single-point failure free)
Integrated or external EMI input filter	Active OR-ing
Programmable UVLO	Adjustable output voltage
Telemetry	Telemetries (On/Off status, input current, output voltage, temperature)
Synchronous rectification	Isolated pulse command interface
70V, 100V, 120V nominal input voltage	Active current sharing
Triple output	Available as complete unit (chassis)
Displacement damage rated	
SMT package (ARA Series)	
Cold Rolled Steel, AlSi and AlsiC package	

Rad hard hermetic hybrid isolated DC-DC converters

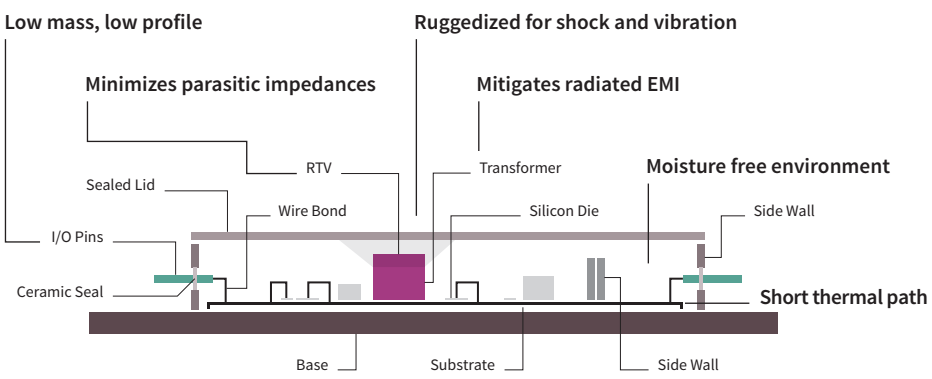
Made in the USA, IR HiRel's rad hard hermetic hybrid isolated DC-DC converters use our JANS-qualified rad hard MOSFETs in rad-hard-by-design architecture for the highest reliability and performance in radiation environments over mission life. Hermetic hybrid technology delivers high electrical performance in harsh environments: the hybrid technology enables circuit operation at high frequency with solid efficiency resulting in 20 to 40% smaller footprint and lighter weight. Qualified up to MIL-PRF-38534 Class K, select models are available as Standard Microcircuit Drawings (SMDs).

With over 500 years of combined hybrid converter engineering expertise, IR HiRel offers a broad portfolio of proven, rugged, fully derated converters that can be used as is in many applications with limited design efforts by the equipment designers:

- General purpose and application-specific DC-DC converters, including MIL-STD-461 filters
- Standard and advanced functionality and operational protections to support a wide range of applications
- Use AlSiC and AlSi light weight and thermally efficient packaging material
- License-free exportable (EAR99) options
- DLA-approved Radiation Hardened Assurance (RHA) plan
- Fully de-rated up to full output power level and operating temperature range
- Immunity to TID, SEE, neutron and prompt dose radiation environments in space documented with detailed radiation reports
- End-of-life performance verification with supporting derating, thermal and worst case design analyses

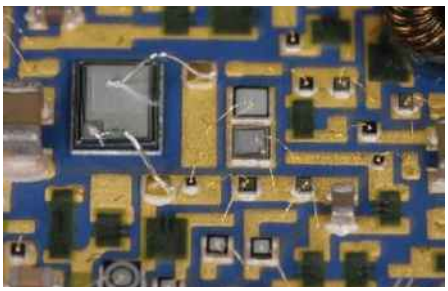
Our products are supported by our applications engineers to provide the necessary information to select the most suitable product to the application and help customers with the necessary technical information to meet the program requirements.

Space level reliability is based on extensive testing and manufacturing documentation which IR Hirel makes available to our customers. All orders are build-to-order in a single production lot using with all materials from the same manufacturing lot or incoming inspection lot for each element, manufactured under the same manufacturing techniques and controls, in compliance with MIL-PRF-38534.



Features

- Broad input voltage range
- Available for spacecraft buses from 28V to 120V
- Total dose (TID) up to 200 krad (Si)
- SEE rated up to 82 MeV-cm^2/mg LET
- Reliable operation over a range of load and electrical requirements
- Light, compact, thermally efficient hermetic hybrid packaging



Advanced compact hermetic hybrid technology

Space-ready hybrid DC-DC converters portfolio

Power	Series	Key characteristics		Size/Weight
120W	GHP	**Highest rad hard power density** 40W/in³ 28V and 120V input, single and dual outputs	IBC for high power FPGA/ ASICS and their peripherals	3.5” x 2.5” 110g AISiC
50W	GH	Output voltage as low as 1V or bus converter First hybrid space converter with **synchronous rectification**	Best in class efficiency SMD on all standard models	3.5” x 2.5” 110g AISiC
40W	M3GB	**Best-selling rad hard hybrid converter** 200 krad (Si) TID minimum, displacement damage and prompt dose hard	28V, 70V, 120V input Single, dual and triple output Integrated 461 filter	3.5” x 2.5” 100g AISiC
30W	LSO	**Single Point-of-Failure-Free converter** with integrated 461 filter, with telemetry, overvoltage protection, programmable UVLO	Output voltage as low as 1.5V, SMD on all standard models	3.5” x 2.5” 125g CRS
30W	LS	Popular, compact converter with integrated MIL-STD-461 filter	28V input, output voltage as low as 1.5V, SMD on all standard models	2.3” x 1.5” 80g CRS
10W	S	Compact converter with external MIL-STD-461 filter	28V input, single and dual output, SMD on all standard models	1.7” x 1.3” 50g CRS
5W	ARA	**Compact, lightweight surface mount lead attach** 28V and 100V input, single and dual output	High effciency, low ripple and transients	1.075” x 1.46” 15g AISiC

Size/Weight include flanges and pins

GHP series (120W)
GH series (50W)
M3GB series (40W)
LSO series (30W)

LS series (30W)

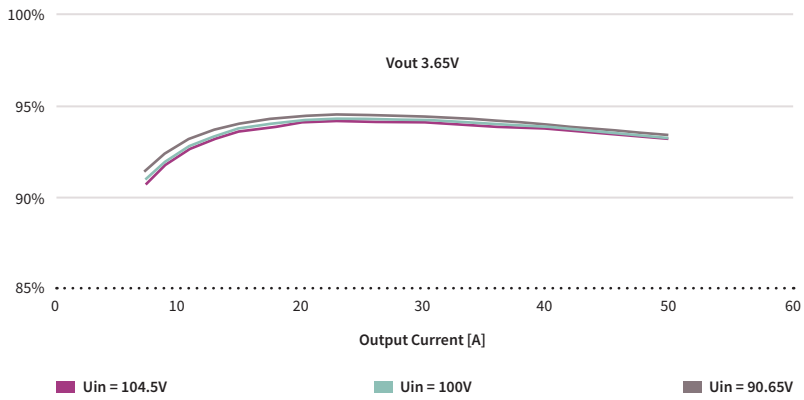
S series (10W)

ARA series (5W)

PCB open frame and enclosed power supplies

EAR series

IR HiRel offers a range of customizable rad hard PCB open frame and enclosed power supplies with high performance and maximum flexibility. Based on flight-proven designs, IR HiRel’s world-class power solutions use advanced topologies and integrated magnetics to deliver high efficiency, lightweight solutions with excellent overall performance.

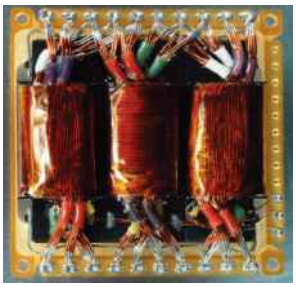


ZBR-series high efficiency DC-DC converter, efficiency includes active OR-ing

Typical features

- Customer adaptable input from 18V to 120V
- UVLO configurable
- Input filter configurable to any satellite platform and payload requirements
- Customer adaptable outputs
- Output sequencing and overload protection
- Output accuracy ±2% worst case at EOL
- Total ionizing dose (TID) 100 krad
- SEE rated at 60 MeV•cm²/mg LET
- Isolated telecommand
- Telemetry (e.g. input current, output voltage, temperature)
- Output ripple < 0.5mVrms (50Hz to 50MHz)
- CS rejection input to outputs at 95dB

Common design concept and features for user-friendly highest technical performance



Advanced magnetic design and converter topologies for best efficiency

- Application-specific power converters to match customer requirements for individual output regulation and features for redundant operation and output protection
- IR HiRel has specific expertise in EPC for RF with output sequencing, in-orbit output voltage adjustments, very high CS 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 ensure compatibility to different power buses and program requirements with minimal engineering effort, and short lead time without undue risk

Construction

- Multi-layer polyimide PCB (Tc math with SMT parts)
- No floating metal (no charge build-up due to radiation)
- Conformal coating and double insulation
- Qualified staking for large components for vibration and shock
- Qualified component mounting (shock, vibration and thermal cycling) to ensure margin to in-orbit mission profile

Space-grade isolated PCB-based power supplies 100 krad, LET 60 MeV•cm^2/mg from 5W to 500W

Series	Model	Output	Power (W)	Size (mm)	Weight (g)	Key benefits
M-series (5W-25W)	MLN	2	5	50 x 60	<40	Very good CS rejection (input to output) combined with low output noise (<1mVrms), high output voltage accuracy and output sequencing makes the M-series ideal to typical low power RF applications.
	MAS	3	15	50.8 x 85	<72	
	MAHB	4	20	71 x 85	<95	
	MBH	3	25	68.5 x 105	<115	
E-series (75W-210W)	EAL	4	75	80 x 142	<200	Combination of high-efficient main output with low-noise aux outputs and output sequencing is ideal for RF HPA applications. The EGB-series can provide output voltages up to 60V in support of RF HPA using GaN RF transistors.
	EARB	3	130	65 x 155	200	
	EARC	3	170	84 x 155	<285	
	EART	3	140	84 x 155	<285	
	EGB	3	210	95 x 153	<300	
	EADP	4	200	103 x 171.5	<400	
EB-series (200W-400W)	EBS	1	400	32 x 227	<900	The EBS is ideal to create a single-point failure free secondary power bus in the 28V range. Offered as a complete unit (chassis), hot redundancy and parallel operation with current sharing allows for easy power scaling and to ensure required reliability.
Z-series (180W – 325W)	ZB	1	250	100 x 150	<350	The ZB and ZBR series provide very high efficiency through isolated single-stage conversion from the satellite bus to end user for output voltages down to 1V. The ZAC is a fully controlled current source for driving laser diode arrays for optical links. The external user settable current and voltage enables matching to the laser diode array.
	ZAR	2	100	20.6 x 161.9	700	
	ZBR	1	180	20.6 x 161.9	700	
	ZAC	1	325	100 x 254	<900	
TPSU-series (400-500W)	TPSU	4	400	120 x 240	<700	The TPSU(R) is specifically developed for radar applications with pulse-loading – as a supply for T/R modules. The TPSU also supports GaN-based RF HPA for continuous wave up to 400W DC power needs.
	TPSUR	7	500	165 x 338	3600	

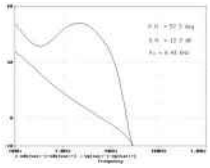
Custom capabilities to meet specific mission requirements

IR HiRel develops hybrid DC-DC converters and PCB-based power solutions compliant to specific mission requirements or applications that cannot be met with standard products or which require mission specific compliance documentation.

IR HiRel's expert team regularly works with customers to adapt standard platforms or design fully custom products to address complex, specialized program requirements and applications, including options for parallel operation and redundant systems. Created in partnership with customers, IR HiRel's custom rad hard power solutions are engineered for optimal system-level integration, reducing development effort and risk.

IR HiRel follows a program-managed gated product development process that provides all necessary analyses and documentation, verification and validation to execute mission-specific programs to ensure smooth release to manufacturing and successful qualification.

Specification review and development plan



Electrical and mechanical design and analysis

Process engineering and design validation

Manufacturability readiness, manufacturing and qualification

IR HiRel: rad hard power you can count on

Backed by IR HiRel's vast space heritage, customers can source high-reliability, qualified products that are manufactured in the USA, and 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 or limited de-rating or external circuitry.

IR HiRel delivers a range of products based on standard platforms using our well-known rad hard power MOSFETs and general design philosophy which can be tailored to the customer's program requirements and compliant to customer Source Control Drawing (SCD). Whether you need a standard, derivative or fully customized rad hard power solution, all models and variants can be supplied with full data analysis package.

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