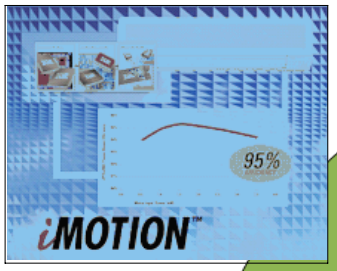
HiRel Overview
October 2008

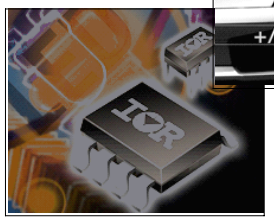
International
IOR Rectifier

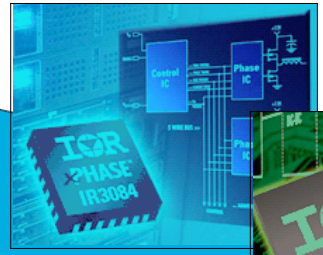
Leader in Power Management

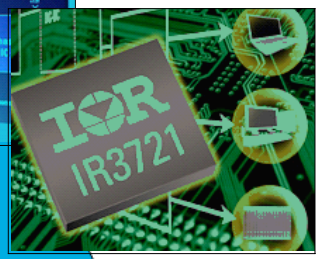
- Established in 1947 (NYSE: IRF)
- Industry leader & pioneer in power management technology
- Strong brand recognition & customer loyalty
- Focused business model – Analog, Digital and mixed signal ICs & Discrete products targeting power management applications
- Holder of over 480 technology patents
- Operations in 20+ countries
- Over 4,500 employees world-wide

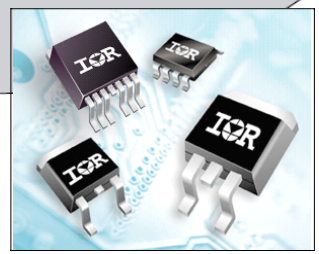
IR Product Mix











- Automotive
- Motion Control
- Lighting/Display
- Audio
- Satellites & Aerospace

- Enterprise Computing and Storage
- Netcom
- Desktop/Notebook
- Gaming

HiRel Overview

- 16% of the company annual revenue
- Over 450 dedicated HiRel Employees
- One of the largest dedicated high reliability power management companies in the world
- One of the few suppliers offering standard and turn-key power management solutions
- One of the largest suppliers of high reliability DC-DC converters in the world
- IR delivers over 2,500 space DC-DC converters and over 30,000 non-space high reliability DC-DC converters annually
- Overall on-time delivery record of >90%

HiRel Design/Manufacturing Facilities

- **Leominster, MA**
  - MIL-PRF-38534 Class K and MIL-PRF-19500 Class S qualified
  - ISO 14001, ISO 9001, and AS 9100 certified
  - Design, assembly, test and qualification for discrete and hybrid product lines

- **Santa Clara, CA**
  - MIL-PRF-38534 Class K qualified
  - ISO 9001 and AS 9100 certified
  - Design, assembly and test for space level DC to DC converters

- **El Segundo, CA - Temecula, CA**
  - MIL-PRF-19500 Class S qualified wafer fabrication facilities
  - ISO 14001, ISO 9001 certified
  - El Segundo design center for RAD-Hard power semiconductors

- **Skovlunde, Denmark**
  - ISO 9001 and AS 9100 certified
  - Design center for space level DC to DC converters and power systems

Key HiRel Milestones

1984 – Established as dedicated business unit within IR

1988 – Introduced world's first RAD-Hard MOSFET

1998 – Released R5 RAD-Hard MOSFET technology

2000 – Acquired ***Omnirel***, power semiconductor module designer/manufacturer

2000 – Acquired ***Magnitude-3***, hybrid DC-DC converter designer/manufacturer

2001 – Acquired ***Lambda Advanced Analog***, hybrid DC-DC converter designer/manufacturer

2002 – Acquired military line of power MOSFETs from ***Fairchild*** (***Intersil***)

2002 – Centralized discrete and module assembly/test in Leominster, MA facility

2003 – Acquired assets of ***Alcatel Space*** Denmark and established a design center for advanced space DC-DC converters

2004 – Introduced industry first RAD-Hard Logic Level Power MOSFET

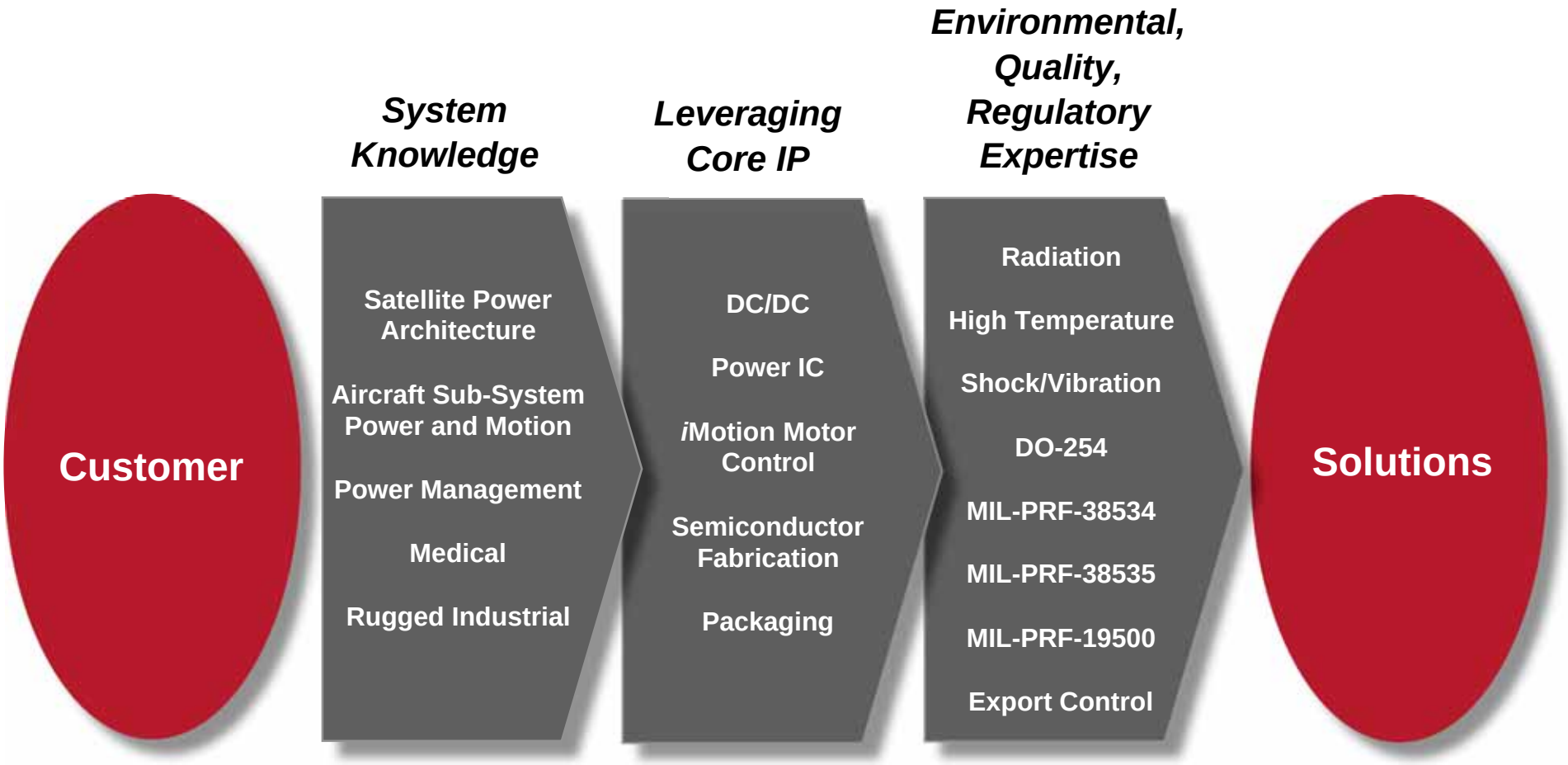
2005 – IR's RAD-Hard Solid State Relays replaced Electro-Mechanical Relays / A&D Facilities Achieved AS9100/ISO9001 Certification/ Released R6 RAD-Hard MOSFET technology

2006 – Introduced LS Series, RAD-Hard, Low-Voltage DC-DC Converters with Built-In EMI Filtering

2007 – Introduced QPL-Certified Schottky Rectifiers for High-Reliability Power Systems

2008 – Introduced Mx Series – triple output DC-DC power converter design platform for space applications

Customer to Solution



Value Added Solutions

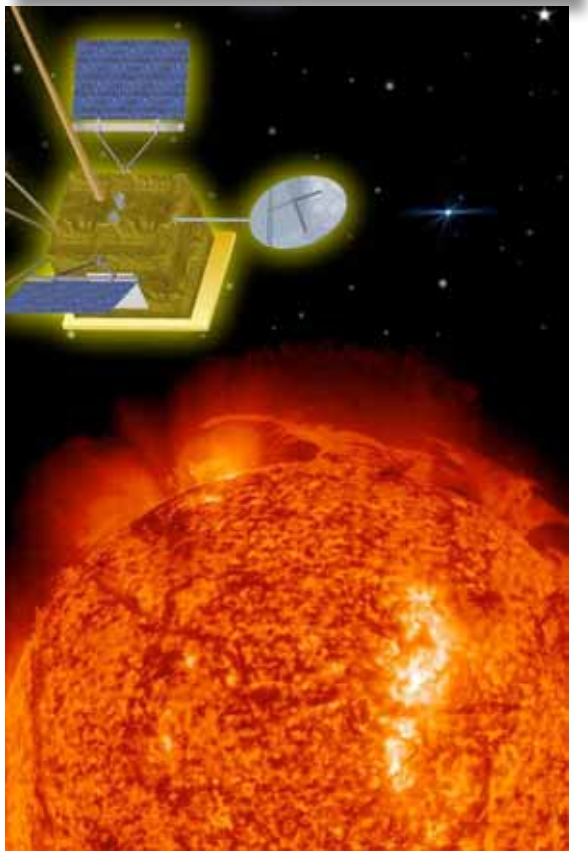
Market Segment	Customer Challenges	IR Solutions	Value
Space	**Power Efficiency** • Battery Operation • Fuel Consumption	**DC/DC Converter Modules** • Hermetic and RH • 5w to 200w	Low Risk
Military	**Demand For Increased Functionality** • Same Form Factor • Denser Electronics	**Power Management Modules** • RH and non-RH Power switches • RH Linear Voltage Regs • Analog and RH motor control	Strong Heritage
Commercial Aircraft	**Extreme Conditions** • Space/Radiation • Shock/Vibration • Temperature • Corrosion	**Discrete and IC Power Devices** • RH and non-RH MOSFETs, Schottkys • RH Power ICs • QPL Plastic	Technical Support
Heavy Duty Industrial	**Reliability** • End System Value • Safety Critical System • Required Life Span		Higher Efficiency
Medical			Reduced Form Factor
			Increased Power Density
			Weight Reduction
			Higher System Design Integration
			Environmental Survivability

Key Test and Process Capabilities

- Class K facility for component and hybrids per MIL-PRF-38534 and MIL-PRF-19500
- Test capability for linear, mix signal and discrete technology
- Environmental testing to MIL-PRF-38534, 38535 and 19500
- Radiation Testing
- DPA and FA analysis
- Thick-film screening and firing
- Furnace substrate and die attach
- Manual and automatic wire bonding processes (Al and AL)
  - Thermo-compression
  - Ultrasonic – 1-20mil Al
  - Thermo-sonic – 1-3mil Au
- Projection weld and seam sealing
  - Parallel resistance seam sealing
  - One shot resistance seam sealing
  - Vacuum furnace soldering
- Automatic electrical test
- Full in-house reliability screening
- Surface mount on PCB assembly
- Chip on board

Space Flight Heritage

- **Over 4,000 space converters delivered**
- **Over 2,000 are in orbit**



PRODUCT FAMILY	RATING OUTPUT POWER, TID, SEE	PROGRAM
AMA	5W, 30Krads, 60MeV	MER
AMF	12W, 30Krads, 60MeV	STEREO, MESSENGER, MER, Lisa Pathfinder
AMR	30W, 30Krads, 60MeV	MBXX (Commercial launch vehicle), STEREO, MESSENGER
ARH	30W, 100Krads, 83MeV	LPE, Solar B, DAWN
ART	30W, 100Krads, 83MeV	SORCE, GALEX, Bsat-2a, Bsat-2c, N-STARc, PanAmSat-1, Indostar-1, INSAT, H2A 2nd Stage, Radarsat, MINU, Beam Link, ASCAT, ACE, ADEOS, Arabsat, Asiasat, AXAF, Chinasat, CRRES, EOS, Eurostar, Eutelsat, FUSE, Geolite,GPS II, Helios, Hispasat, HST, Indostar, Intelsat, ISS, Mars Surveyors, Meteosat, NEAR, NPOESS, Orbcomm, Orbview, Planet B, Quickbird, Sirius, SIRTF, Spacebus, Stardust, Turksat
EB	160W, 100Krads, 60MeV	Globalstar II
EPC	235W, 100Krads, 83MeV	GPS IIR-M
LS	30W, 100Krads, 83MeV	Solar Dynamics Observatory (SDO), JWST, LRO (Lunar Reconnaissance Orbiter), GPM (Global Precipitation Measurement), ST-8 (Space Technology 8), HST (Hubble Space Telescope), ODTML (Ocean Data Telemetry Microsat Link). Mini RF, SmartSAT, DRP, JEM (ISS), Go-SAT, NPOESS, P-734, P-741
M3G	40W, 200Krads, 83MeV	Living with a Star, HIFES, INSAT, Solar B, GPS IIF, B2, RRGU, FOG, Classified (fiberoptic gyro), SSTING, NPOESS, Terrastar, ICO, P-734, P-741, JWST, Planet C, QZSS, Chandrayaan, Astrosat, MUOS, B2
M3H	40W, 25Krads, 37MeV	H2A, IRS, RRGU, FTINU
MA	5W, 100Krads,82MeV	Customer Confidential Porgrams (2)
MB	15W, 100Krads, 82MeV	MUOS, Hylas, PAN
M3L	25W, 25Krads, 37MeV	SERVIS, STEREO
S	10W, 100Krads, 83MeV	GPS IIF. STEREO, JWST (James Webb Space Telescope), SSTING, NPOESS, P-741, P-734, ELC (Express Logistics Carrier)
Z	30-50W(15A), 100Krads, 83MeV	Classified, JWST
ZA	50-100W (25A) 100Krads, 83MeV	P700 (classified)
ZB	100-250W (50A) 100Krads, 83MeV	HPDP

Commercial Aviation Flight Heritage

- Airbus 300
- Airbus 320A
- Airbus 380
- Boeing 737
- Boeing 777

Military Aviation Flight Heritage

- AH-64
- AIM9X
- ATACMS
- Boeing J-DAM
- Boeing AGM130
- Cobra Judy
- DDG 1000 destroyer
- Eurocopter Tiger
- Euro-fighter Typhoon
- Eurofighter
- F16
- F18
- F22 Raptor
- Joint Strike Fighter – F35
- Harpoon
- H60 helicopter
- M1A2 tank
- PAC-3 missile
- Panavia Tornado ADV
- SAAB Grippen
- WAH64 helicopter

Heavy Duty Industrial Heritage

High temperature

- **Mirage**

Undersea

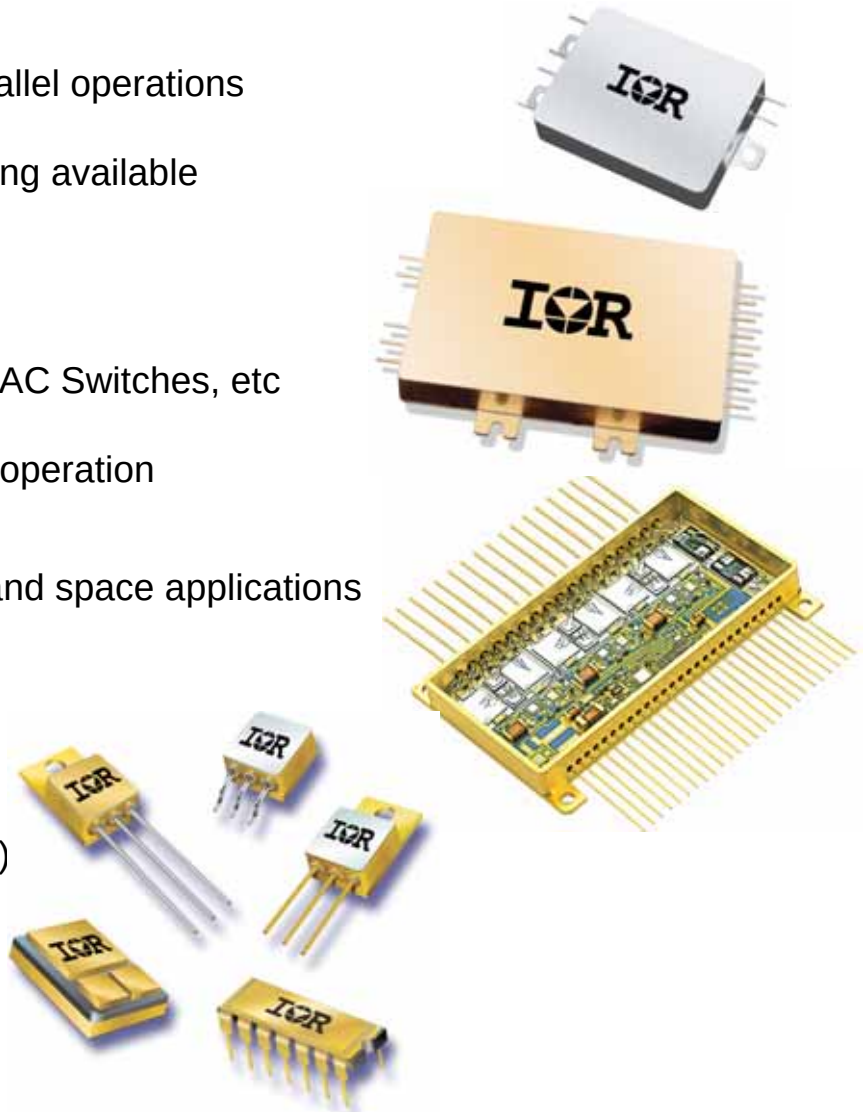
- **Trans Pacific Express**
- **South East Africa**

Medical

- **Implantable Devices**

HiRel Product Technologies

- **DC/DC converters**
  - 5W to >250W output power, higher power with parallel operations
  - Converter efficiency of up to 92%
  - PCB assembly style and enclosed aluminum housing available
  - DSCC class H and K SMDs
  - Single, dual, triple, and quad outputs
- **Hybrids**
  - Application specific hybrids ie: Solid State Relays, AC Switches, etc
  - Custom packaging ie: hermetic and near hermetic
  - Extended temperature range, extensive screening operation
- **Motion Control**
  - Custom solutions for commercial aircraft, robotic, and space applications
  - Half bridges
  - H-bridges
  - 3-Phase bridges
  - BLDC drivers
  - Stepper motor drivers
  - Full Digital Controlled Motor Drive Modules (<5KW)
- **Discretes**
  - RAD-Hard MOSFETs and MOSFET Drivers
  - Logic Level RAD-Hard MOSFETs
  - Hermetic MOSFETs and IGBTs
  - Schottky Rectifiers



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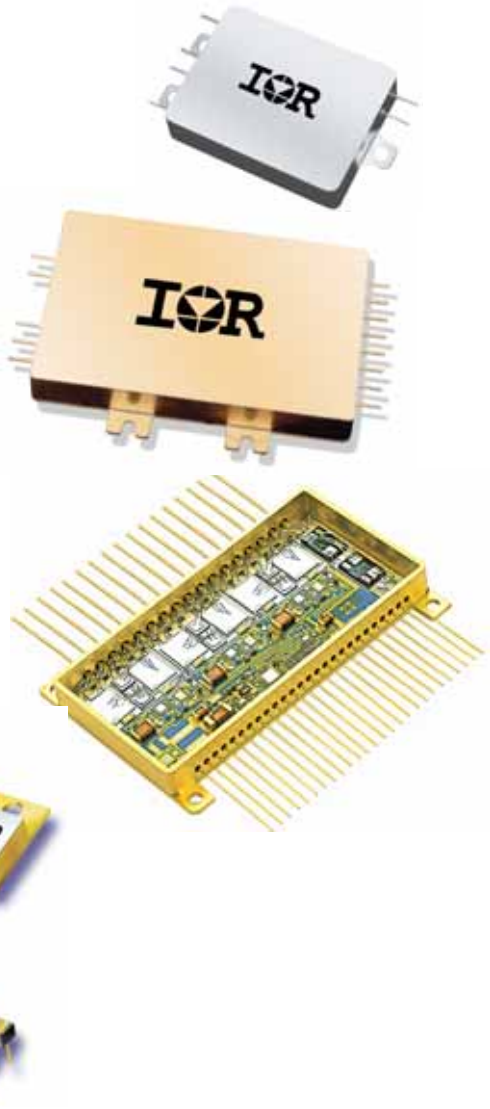
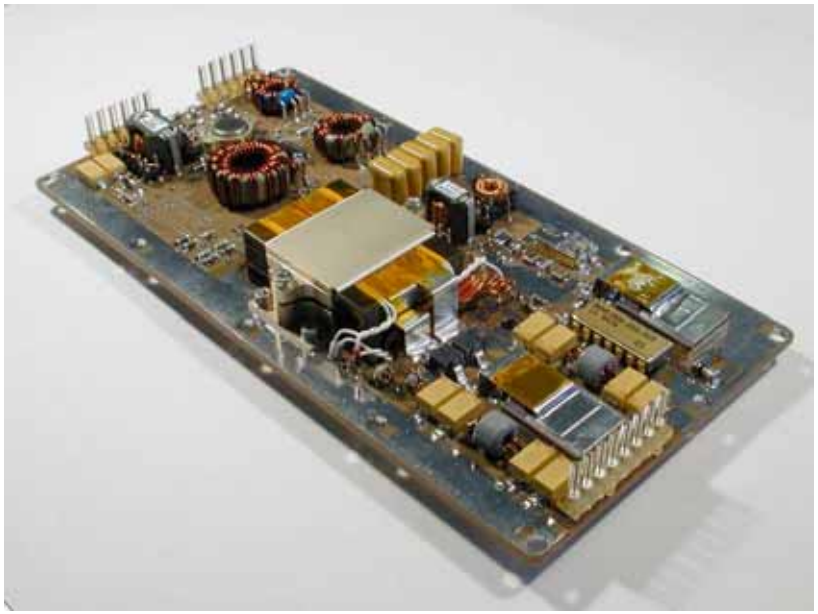


HiRel Space DC/DC Converters

- **Merchant leader in DC/DC converters**
- **Lead in efficiency at > 90% with Zx and Ex platform series**
- **Lead in Low Noise performance with Mx platform series <1mVrms and >95db rejection**
- **Optimize Power Density/Mass with Hybrid technology - LS and M3G platform series**
- **Superior Technical Support**
  - Graveyard unit methodology maintained for all DC/DC converters
  - EOL Analyses - “Off the shelf” standard product analysis report
  - Design Simulation Tools
- **Radiation Expertise**
  - Extensive library of known radiation hard components
  - Shielding expertise
- **Standard Platform/Custom Design Methodology**
  - Quicker design turnaround/Lower engineering effort
  - Higher known reliability
  - Proven design/flight performance
- **Flight Heritage**
  - Unblemished record in space
- **Product Development Direction**
  - Driven by efficiency and power density
  - Application specific converters



20A version of the Zx platform with >90% efficiency

HiRel Non-Space DC/DC Converters

- **AHP/AFL Platform Series**
  - 28V, 50V, 120V, and 270V.
  - Parallel for higher power with equal current/stress sharing.
  - AHP270/AFL270 offers highest power density in the industry
  - Strong heritage - AHP/AFL >100K units since intro over 10 years ago
  - Legacy support – AHP replaces AFL with backward compatibility

- ASA and AHV are designed to meet stringent 80V, 0.1 second per MIL-STD-704A without external filtering required

- ATS includes MIL-STD-461 (CE03) compliant EMI input filter

- **Product Development Direction**
  - Hermetic designs driven by cost, power density, efficiency
  - Reviewing non-hermetic power solutions
  - **Leveraging core design for downhole drilling applications and on engine aircraft usage**

Output Power	Single		Dual		Triple	
5W	ASA		ASA			
6W	ASAP		ASAP			
8W					AHF	
12W	AHF		AHF			
15W	AHV		AHV		AHV	
15W	AHE		AHE		ATO	
20W	AHE	HT		HT		
20W		AHFP		AHFP	AHFP	
25W	ATS*		ATS*			
30W	ATR	ATW	ATR	ATW	ATR	
40W	ATRP	HM*	ATRP	HM*	ATRP	HM*
66W	AFL	AHP				
80W	AFL	AHP	AFL	AHP		
90W	AFL	AHP				
96W			AFL	AHP		
100W			AFL	AHP		
108W	AFL	AHP				
112W	AFL	AHP				
120W	AFL	AHP				

= Recent releases

= Road map product

* Features integrated MIL-STD-461 compliant input filter.

HiRel Product Technologies

- **DC/DC converters**
  - 5W to >250W output power, higher power with parallel operations
  - Converter efficiency of up to 92%
  - PCB assembly style and enclosed aluminum housing available
  - DSCC class H and K SMDs
  - Single, dual, triple, and quad outputs
- **Hybrids**
  - Application specific hybrids ie: Solid State Relays, AC Switches, etc
  - Custom packaging ie: hermetic and near hermetic
  - Extended temperature range, extensive screening operation
- **Motion Control**
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  - Half bridges
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  - BLDC drivers
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  - Full Digital Controlled Motor Drive Modules (<5KW)
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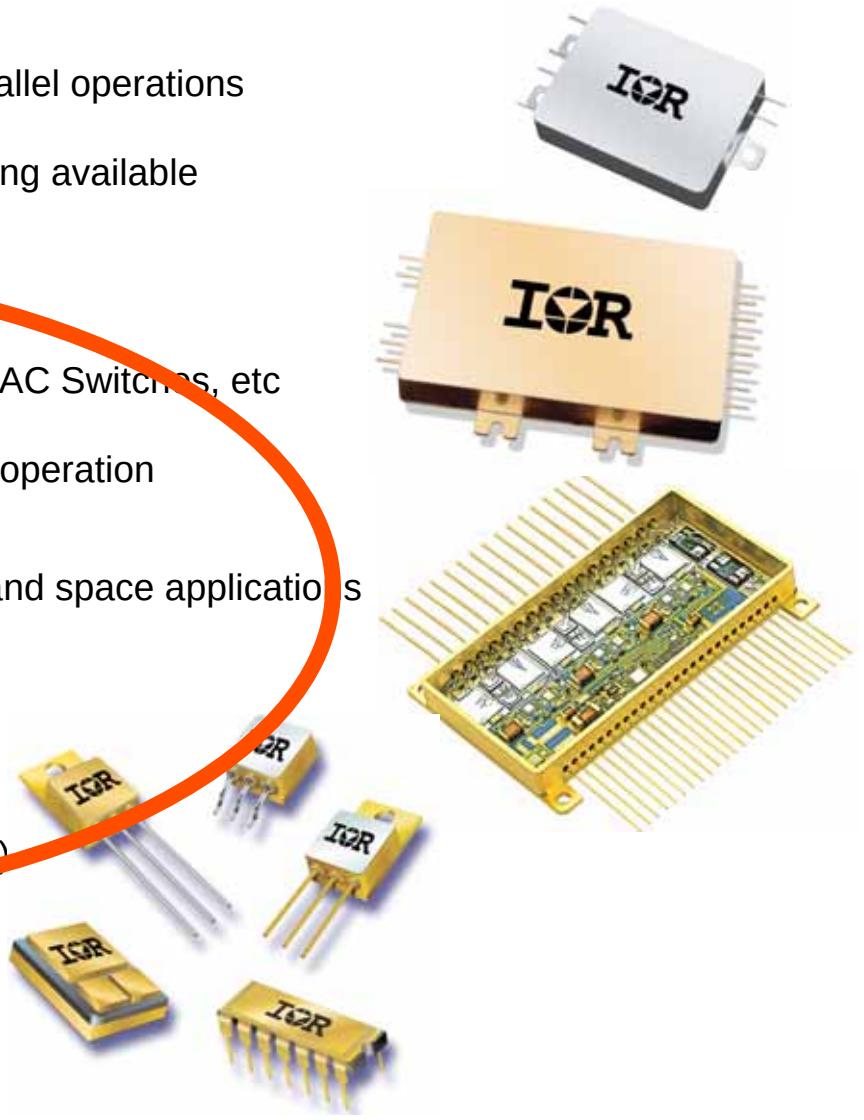
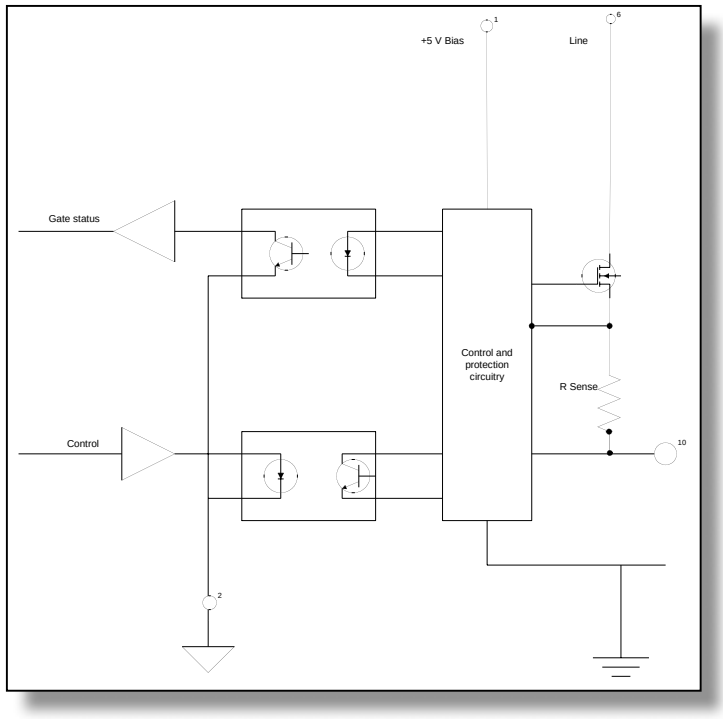


HiRel Hybrids & Motion Control

- **RH Solid State Relays**
  - 1 to 8 relays within, 1.5 to 20A
  - Feature rich: buffered input, logic level input, controlled switching speed for enhanced EMI performance, selective output power stage
  - Power switching including Heater Control

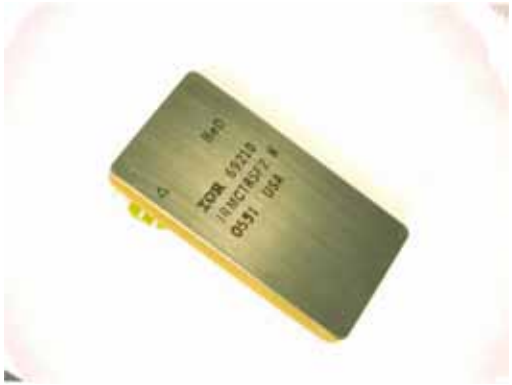
- **RH Solid State Power Controller**
  - i^2t protection
  - Telemetry bit output
  - Short Circuit Protection
  - Total dose capability of 100 Krad (Si)
  - Out rush tolerant
  - Controlled Current Ramp Up (within device SOA)
  - Hardware based logic, No programming required



HiRel Hybrids & Motion Control

- **RH ULDO**
  - 1 Mrad(Si) and 200 krad(Si) TID
  - ELDRs to 500 krad(Si)
  - SEE to LET 84 MeV
  - 3 Amp fixed and adjustable versions
  - 5 Amp fixed types are in development
  - Ultra Low dropout
  - Hermetic thru-hole and surface mount packages
  - Remote shutdown
  - K-Level screening

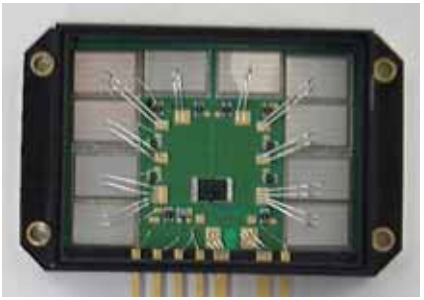
- **RH motor control module**
  - Brushless DC, stepper for NASA Robonaut
  - Housed in a 32 pin Flat Pack
  - TID capable to 100 Krad(Si)
  - RIC7113 driver chip set
  - IRH57230 MOSFET power stage
  - Operating Temp range from -55 to +125 deg C



HiRel Hybrids & Motion Control

- **Total Drive**
  - 28V, 270V and 540V Development Platform
  - 2.5KVA Rating
  - Sensorless Speed Control for PM Motor
  - Low cost rugged non-hermetic package
  - Mixed packaging technology including chip on board

- **IGBT/MOSFET Power Modules**
  - Bridge and half bridge modules
  - Custom configurations
  - Near Hermeticity meets double HAST (200hr, 85/85) testing
  - ~50% lower cost than traditional hermetic sealed
  - -55 to +125 temp operation
  - AC switch for A380 aircraft



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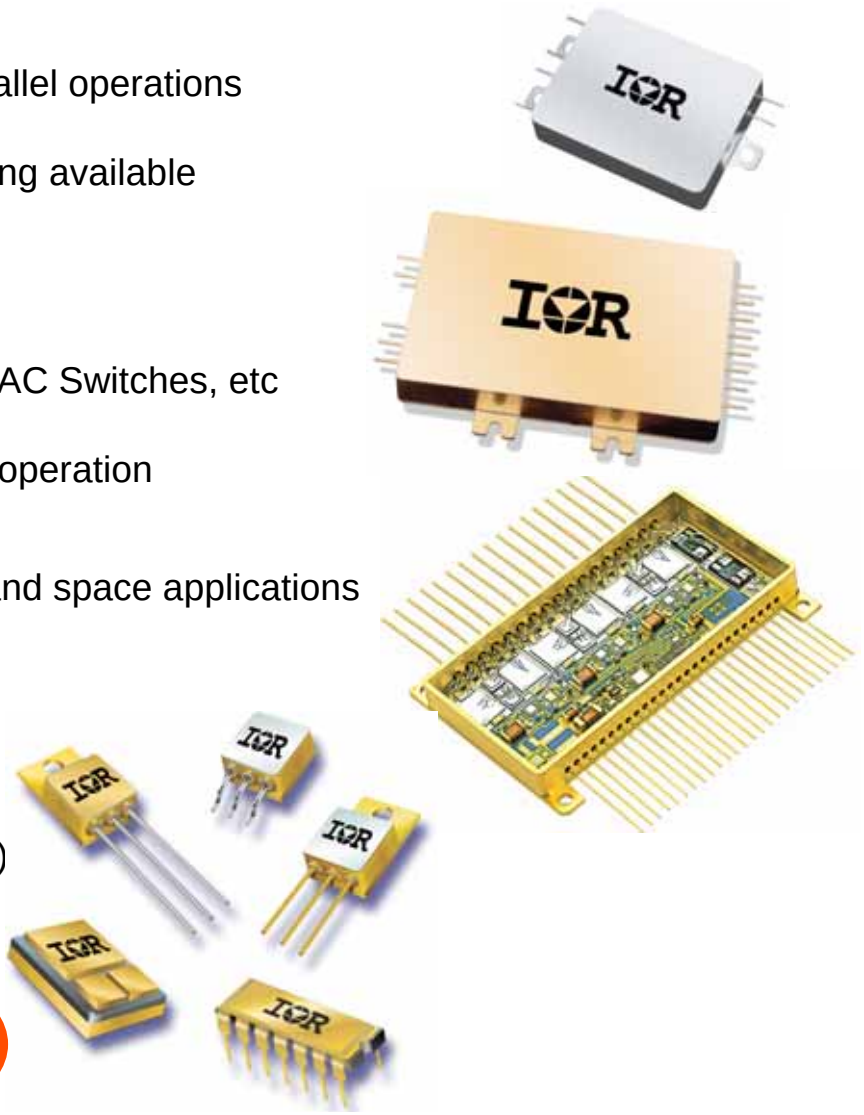
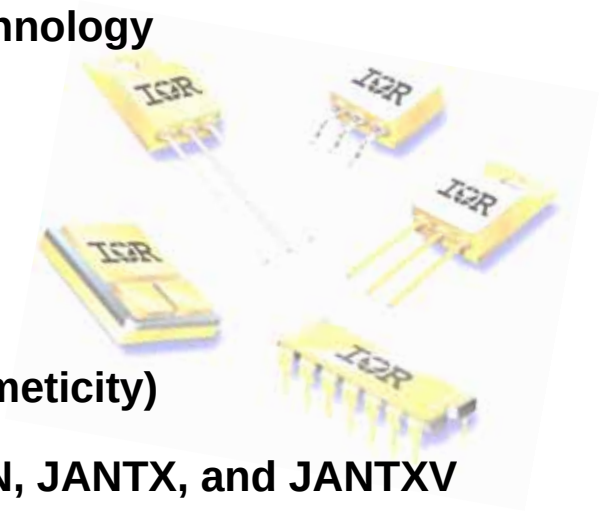
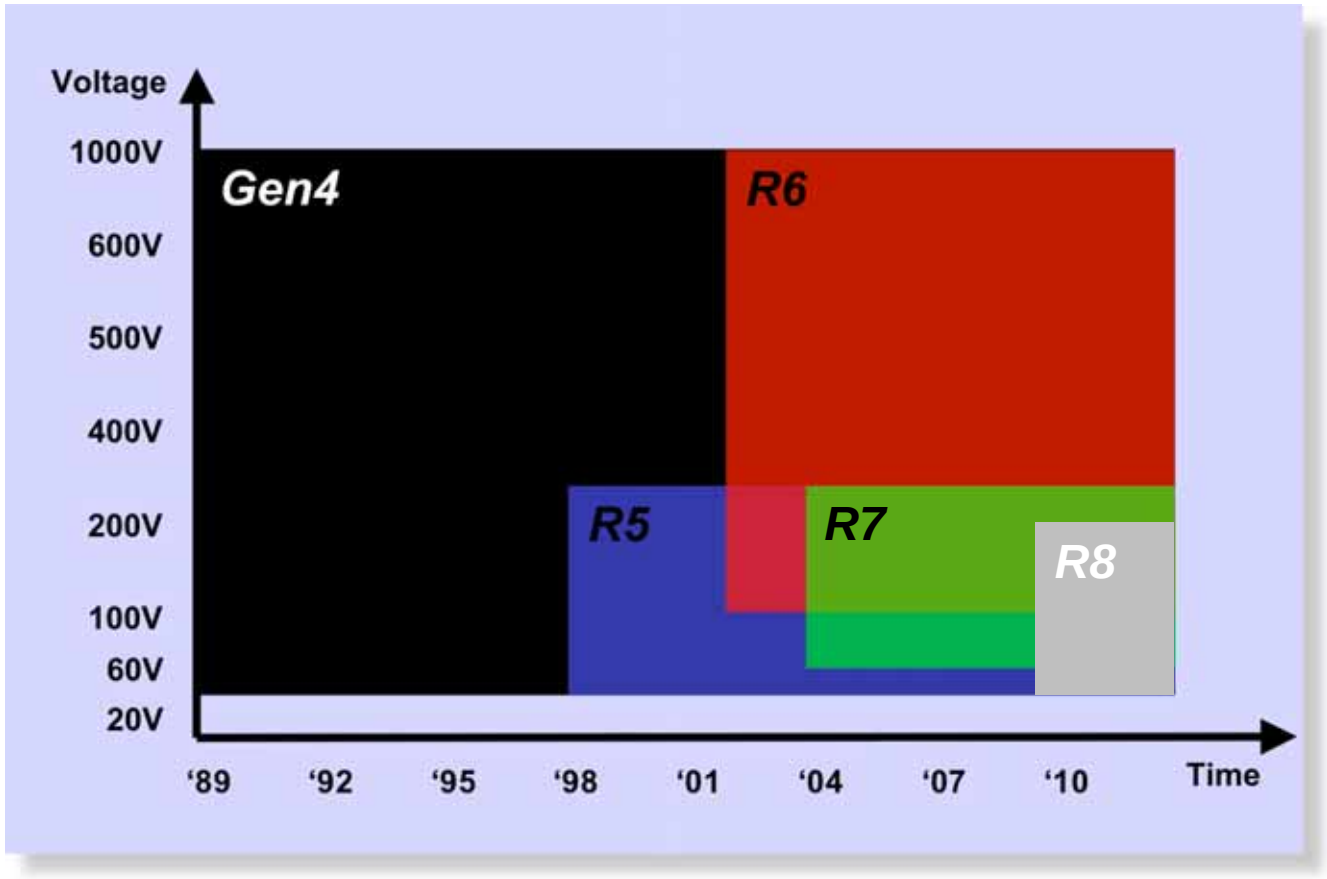


HiRel Discretes

- Leader in RH MOSFETs with Over 20yrs of space flight heritage
- Ensuring state of the art discrete performance available for military and space usage
- Major investments in continued process and package technology
- Defining additional RH IC development
- Standard Portfolio:
  - Radiation Hardened (RH) Hermetic MOSFETs – JANS
  - Std. Hermetic MOSFETS (commercial grade with hermeticity)
  - Std. Hermetic MOSFETs meeting MIL-PRF-19500, JAN, JANTX, and JANTXV screening
  - Schottky Rectifiers
  - Proprietary 1,000V+ MOSFET platform utilized for medical ICD applications



RAD-Hard MOSFET Overview



Gen4

- **30V-1000V**
- **N/P-channel**
- **100K-1000K Rads**

R5

- **30V-250V**
- **N/P-channel**
- **100K-1000K Rads**

R6

- **100V-1000V**
- **N-channel**
- **100K-300K Rads**

R7 Logic Level

- **60V-250V**
- **N/P-channel**
- **100K-300K Rads**

R8 Trench

- **30V-200V**
- **N/P-channel**
- **100K-300K Rads**

FY09 Roadmap Products

New Product	Product Description	Target Applications	Target Market
Rad Hard Synchronous BUCK PWM	High frequency, 2-phase, single or dual output, Rad Hard PWM	Synchronous buck voltage regulator modules for "Point of Load"	Space
R8 Rad Hard MOSFET	Low gate charge, low RDS(on) Rad Hard MOSFET	Switching Power Supplies	Space
Rad Hard PWM	Rad Hard, >1Mhz, Current or Vol Mode, 1A gate drive, 3mA operating current	Isolated DC/DC converters	Space
SBA Synchronous Buck Voltage Regulator Modules	High Efficiency Rad Hard 5W synchronous buck topology, 10V input, low output voltages	"Point of Load," Distributed power	Space
Rad Hard Linear Regulator	Rad Hard, <500mA, Input: 10V, low output voltages	Digital power	Space
Rad Hard Latching Solid State Relay	Latching Solid State Relay, low to medium current, up to 200V input	Heater controller, load switching	Space
High Temperature DC/DC Converter	185C min, 270V nominal input, standard outputs, 25W	Oil drilling	Heavy Duty Industrial
IGBT	1200V, 1700V, medium current	ICD	Medical

Summary

- Provide leading edge power technology for high reliability markets including space, military, heavy duty industrial and medical
- Proven quality and reliability through extensive heritage
- Provide total power management solutions, starting from discrete semiconductors and integrated circuits to hybrids and fully integrated power systems
- Continue to invest in R&D to provide innovative products for high reliability industries