



High-reliability integrated circuits

Components for Hi-Rel Distributed Systems

SPACE IC GmbH

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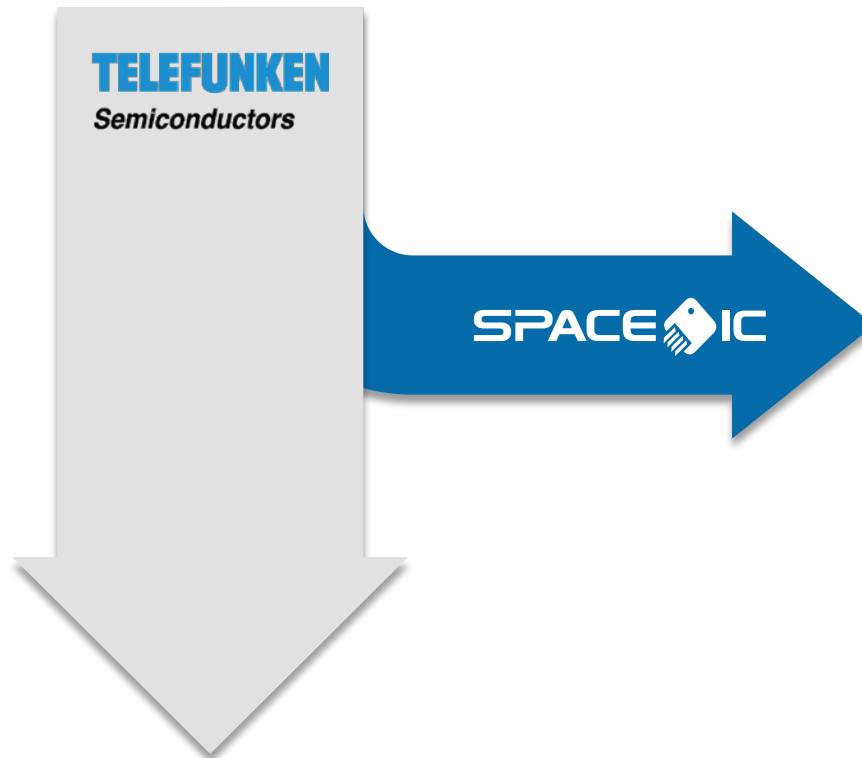
Managing Directors:

Volodymyr Burkhay ▪ Uwe Gieselmann ▪ Marko Reuter ▪ André Rocke
Register: Hannover ▪ Amtsgericht Hannover ▪ HRB 210911



Company

- Foundation of **SPACE IC** in 2014 by experts from the TELEFUNKEN IC product development
- **SPACE IC** exclusively takes over development and manufacturing of rad-hard IC products from TELEFUNKEN



Founder Team & Management Board:



Headquarter:

SICAN Technology Park
in the Northwest of
Hannover, Germany



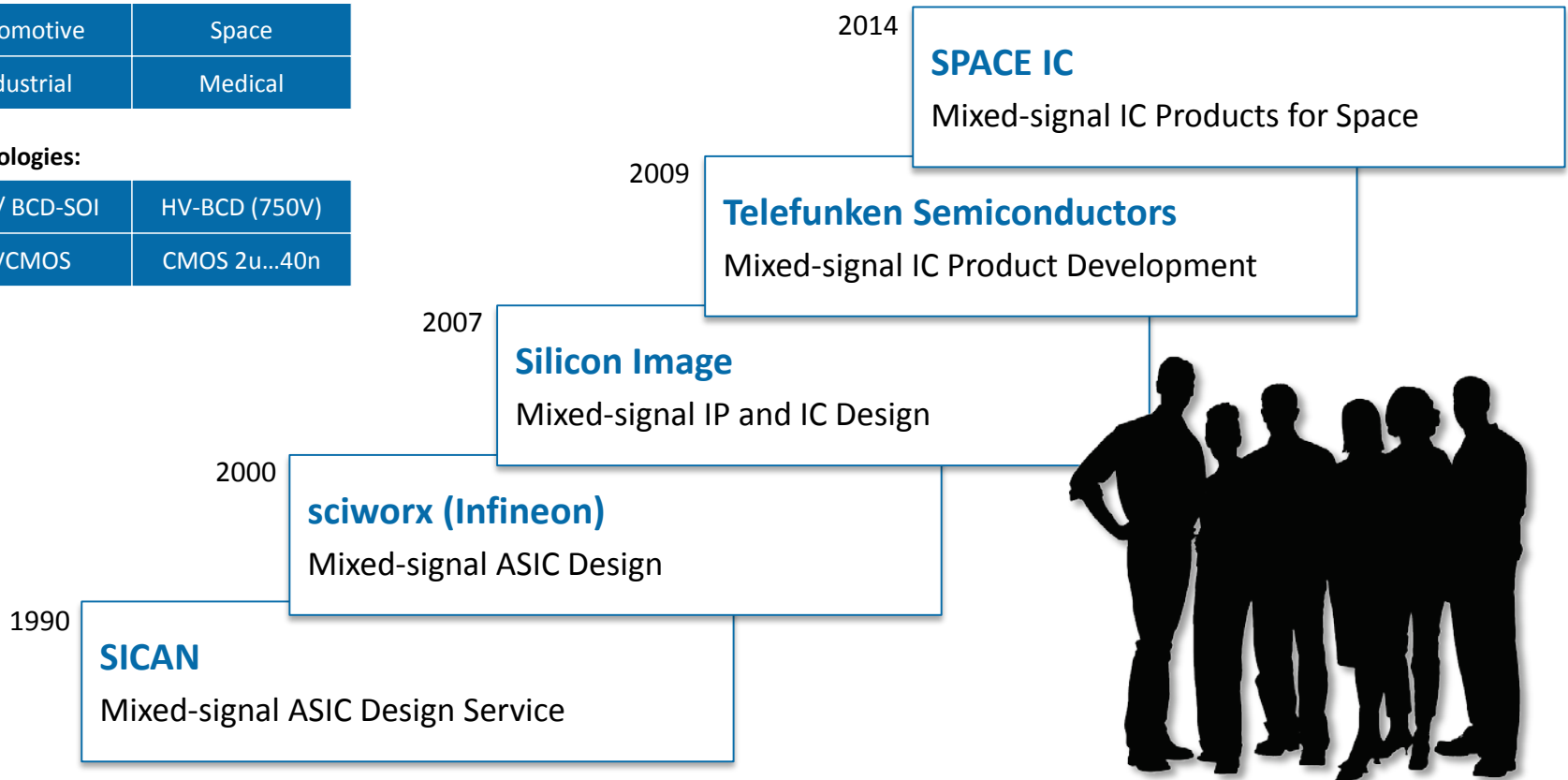
Company Experience

Hirel Applications:

Automotive	Space
Industrial	Medical

Technologies:

BCD / BCD-SOI	HV-BCD (750V)
HVCMOS	CMOS 2u...40n



➔ **CAN Transceiver Physical IPs for Automotive since 20 Years!**



SPACE IC

Technical and Application Focus

- Space-Grade Analog and Mixed-Signal Integrated Circuits for **Power Management** and **Robust Data Interfaces**

IC Product Development

Chip Development:

- IC Spec
- IC Design
- Package Design
- Prototyping

Testing:

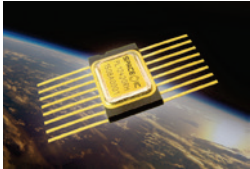
- Screening
- Evaluation
- Qualification

Manufacturing:

- Chip Foundry
- Wafer Test
- Dicing
- Assembly
- Screening
- Qualification Testing

Service:

- Mixed-Signal ASIC Service
- Manufacturing Service



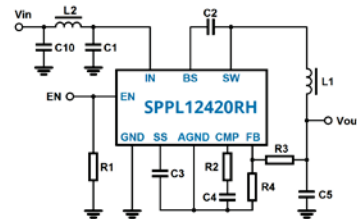
SPACE IC develops, manufactures and sells:

High-reliability radiation-hard analog and mixed-signal integrated circuits for space applications (ITAR/EAR-free)

Power Management

DC power conversion, conditioning and protection (high-voltage capability etc.):

- DC/DC Regulators
- LU Protection
- HV Gate Driver



2A point-of-load DC/DC converter

Interfaces

Robust data interfaces (high-voltage capability, high common-mode capability etc.):

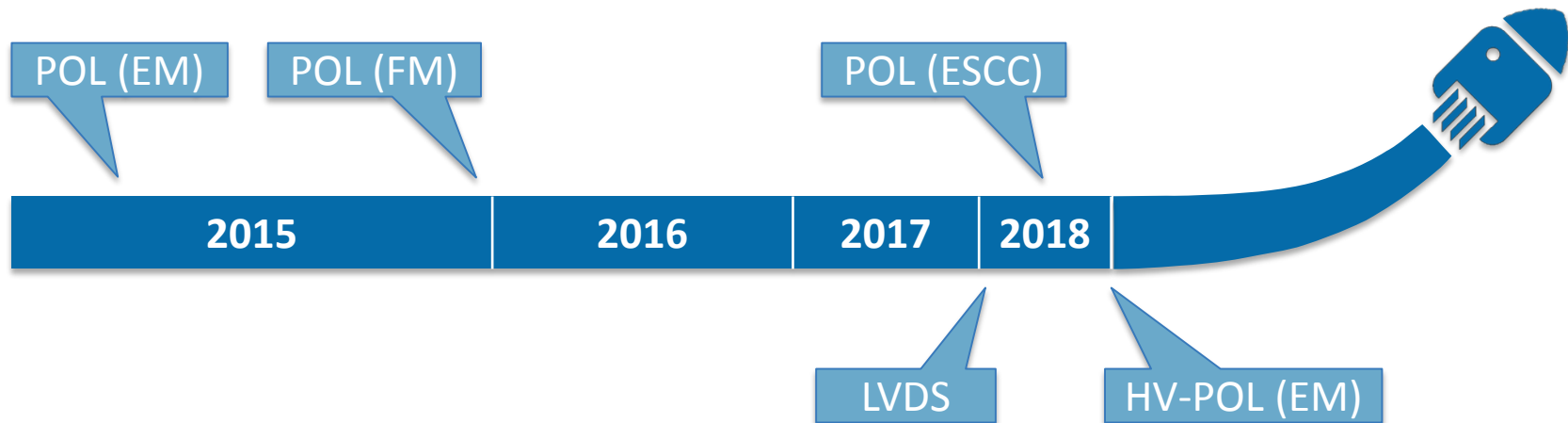
- Extended Common-Mode LVDS (for SpaceWire)
- CAN Bus Line I/O
- CAN System IC



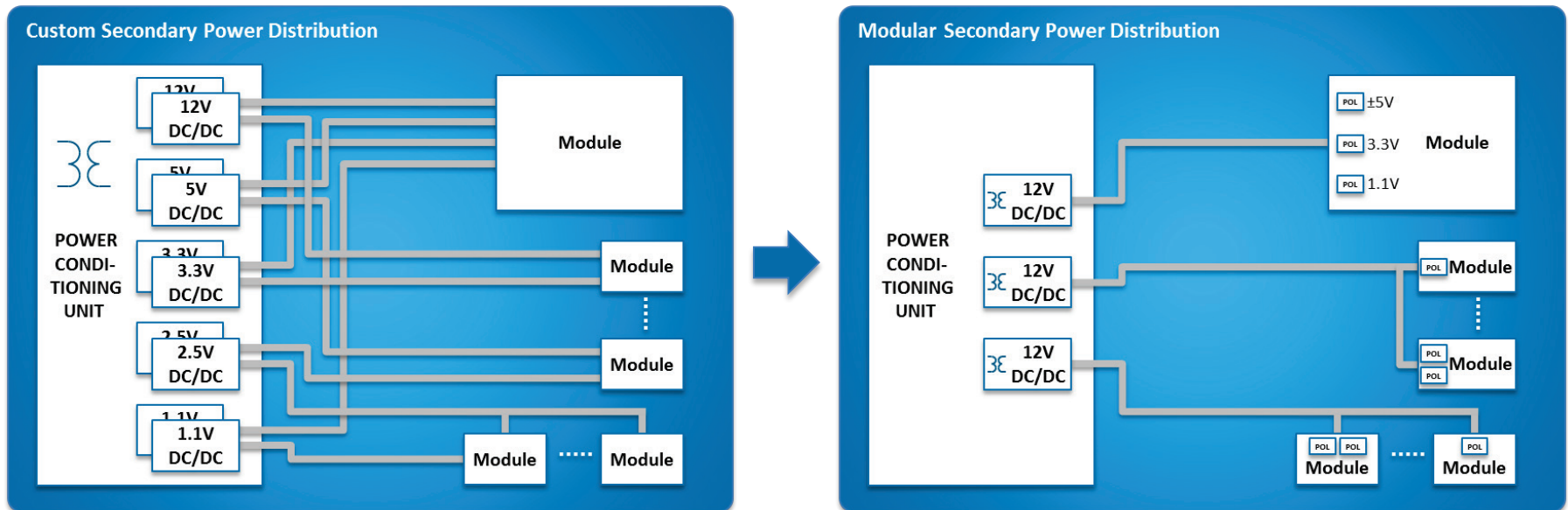
fast box-to-box communication

Product Roadmap

- **POL** switching regulator (power distribution) _____ **SPPL12420RH**
- **LVDS Rx** extended CM receiver (data communication) _____ **SPLVDS032RH**
- **LVDS Tx** transmitter (data communication) _____ **SPLVDS031RH**
- **HV-POL** next generation POL product _____ **SPPL14065RH**



Power Distribution with POL

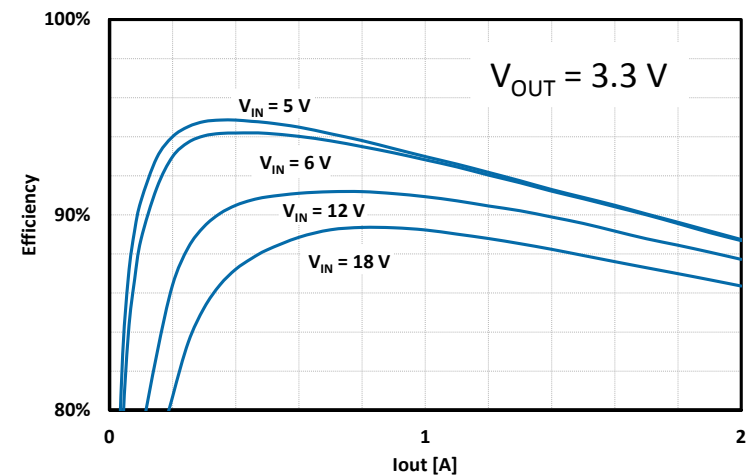
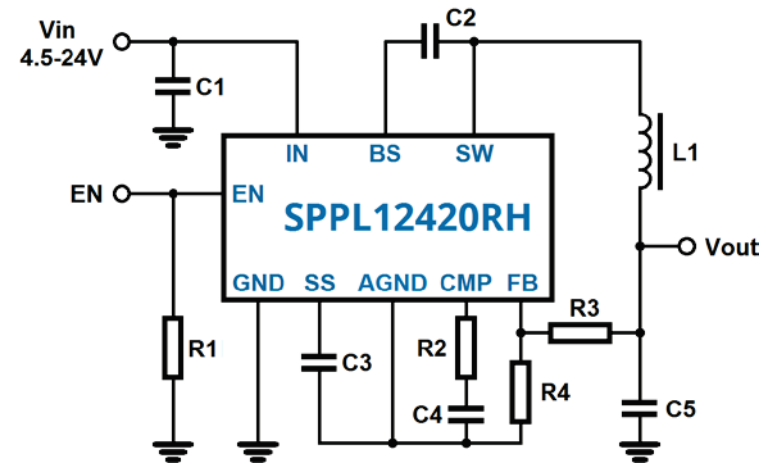


- Modular approach with improved re-use possibilities using intermediate power busses and standard power interfaces
- Highly efficient and accurate power conversion at point-of-load
- Weight & volume of few power rails; lower current

SPPL12420RH

Features

- Ceramic hermetic flatpack package
- SOI technology
- 2A continuous output load current
- 24V input voltage capability
- 4.5V min. input voltage
- 0.923V min. output voltage
- >90% efficiency
- 340kHz fixed switching frequency
- -55°C to +125°C extended temperature range



TID Wafer Lot Acceptance SPPL12420RH

ESCC 22900

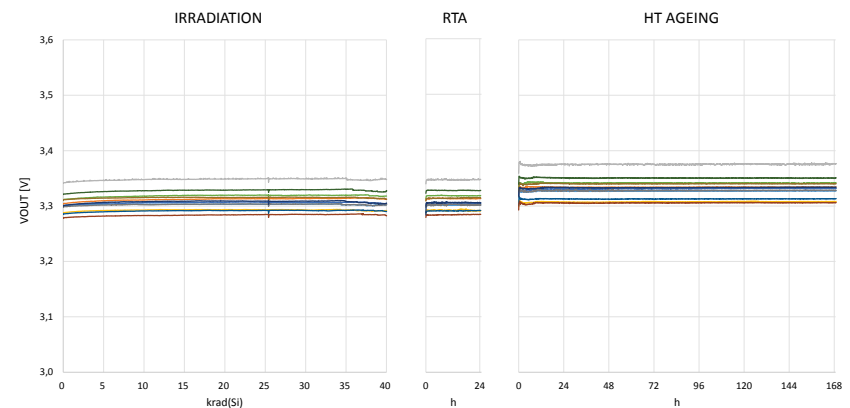
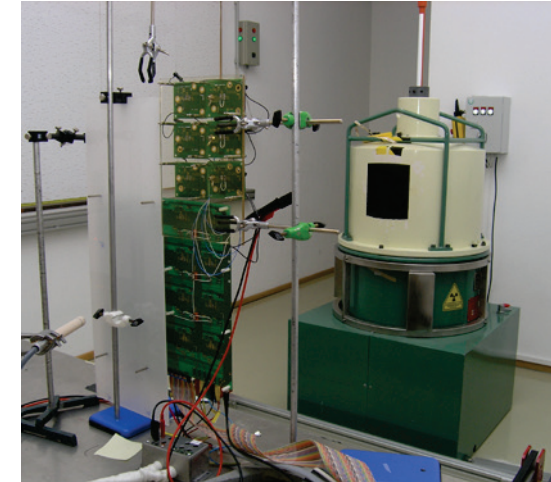
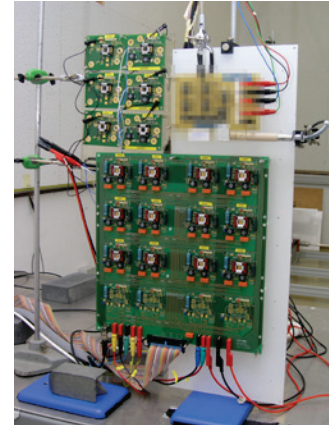
TID test campaign at ESTEC ^{60}Co Radiation Facility

Setup:

- 12 DUTs under worst case biasing and load conditions
($V_{\text{IN}} = 12\text{ V}$, $I_{\text{LOAD}} = 0.4\text{ A}$)
- 3 DUTs unbiased
- Dose rate = 360 rad/h
- 6 extra DUTs as reference group
- Comprehensive testing of datasheet parameters at irradiation stops

Results:

- Biased parts passed **40 krad(Si)**
- Unbiased parts passed **105 krad(Si)**



Heavy Ions Test SPPL12420RH

ESCC 25100

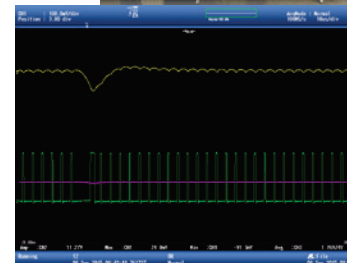
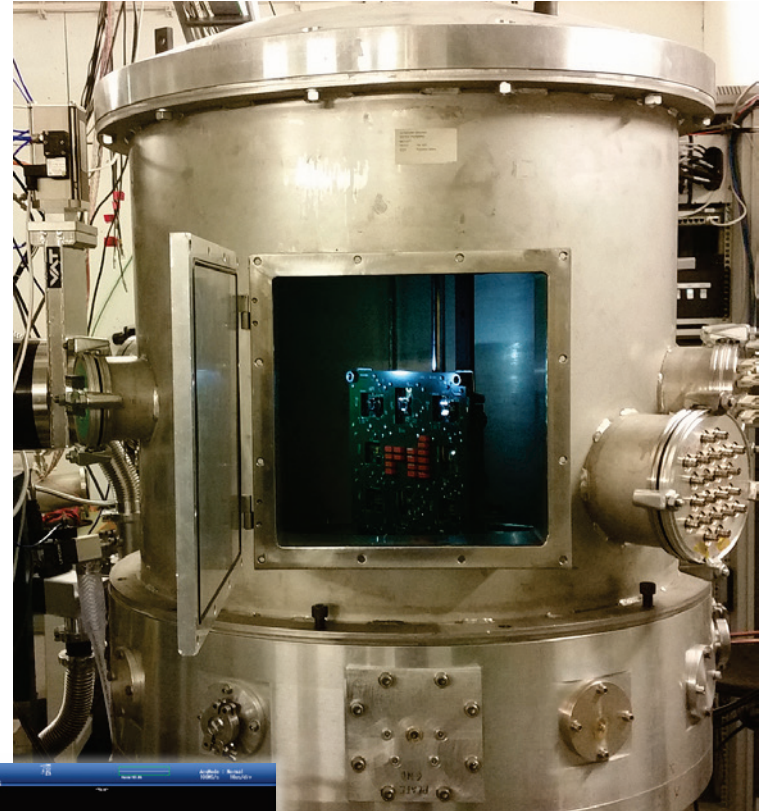
SEE test campaign at RADEF Accelerator Laboratory

Conditions:

- 8 application boards configured for $V_{OUT} = 1.2/1.8/2.5/3.3/5.0/12V$ (3 boards with sockets)
- Worst case configuration for destructive events (most sensitive tilting)

Results:

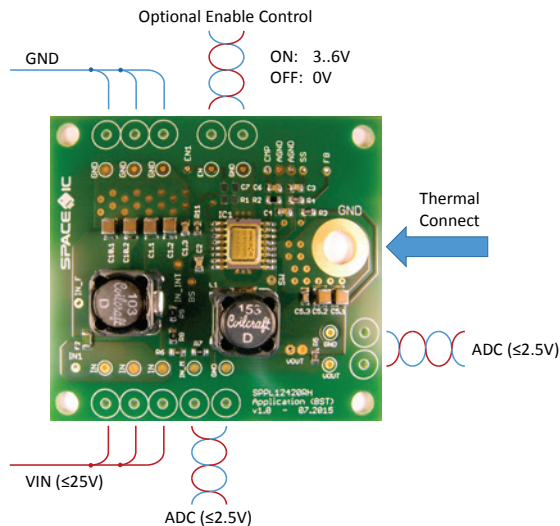
- Max. safe V_{IN} for destructive event free operation in any configuration:
 - $V_{IN} = 11V$ for effective LET of ~ 89 [MeV·cm²/mg]
 - $V_{IN} = 13V$ for effective LET of ~ 60 [MeV·cm²/mg]
- No dependency of destructive SEE event sensitivity on V_{OUT} or its relation to V_{IN}
- Worst case transients in any configuration result in voltage drops max. 5% of V_{OUT} with duration of a few μs
- The most transients result in voltage drops <3% of V_{OUT}



SPPL12420RH Heritage

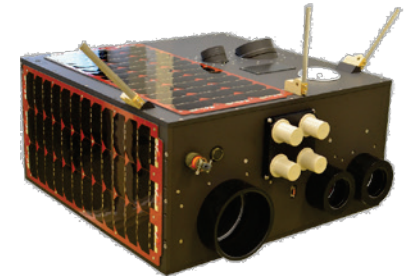
2015

- In-orbit verification of SPPL12420RH in cooperation with Berlin Space Technologies
- SPPL12420RH Engineering Model on special application evaluation board:
 - $V_{IN} = 24V$
 - continuous operation
- Telemetry of V_{IN} and V_{OUT} values



In-Orbit Demo

- Singapore earth observation satellite to support disaster monitoring in Asia
- Launched on December 16th, 2015 into 550km near equatorial orbit



- Telemetry data shows persistent proper operation of the SPPL12420RH

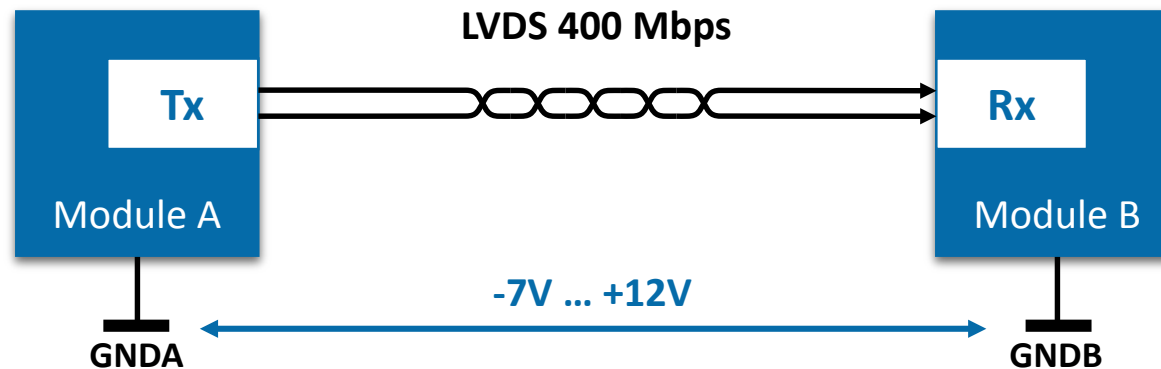
LVDS TX & RX

Communication

- Fast point-to-point data transfer with exceptional ground noise immunity
- Suitable for **SpaceWire** networks
- Suitable to replace **RS-422** or **RS-485**

Advantages

- Compliant to TIA/EIA-644-A
- Extended Common-Mode
- 0 to 400Mbps over single wire pair
- HV robustness, Latch-Up immunity

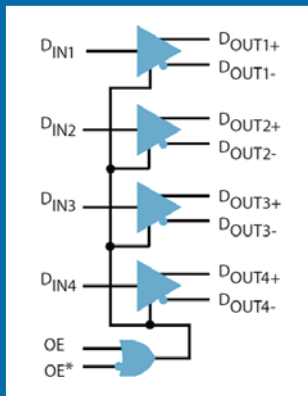


SPLVDS031RH & SPLVDS032RH

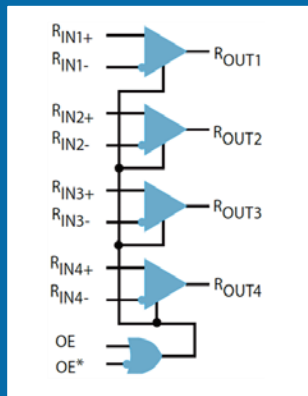
Features

- Ceramic hermetic FP-16 package
- SOI technology
- 400Mbps quad LVDS line translator
- -7V to +12V extended common mode
- Very low skew
- Low current consumption
- ESD HBM >8kV
- -55°C to +125°C extended temp. range

SPLVDS031RH

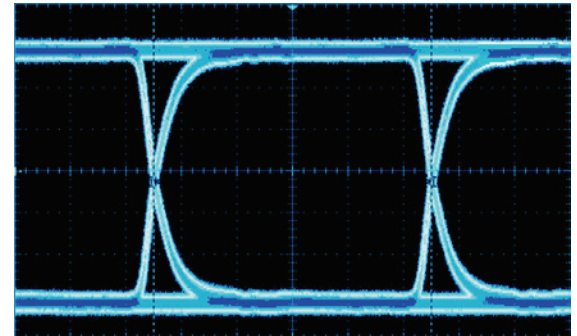


SPLVDS032RH



LVDS signal:

- 400Mbps
- PRBS23



SPLVDS031RH & SPLVDS032RH TID Tests



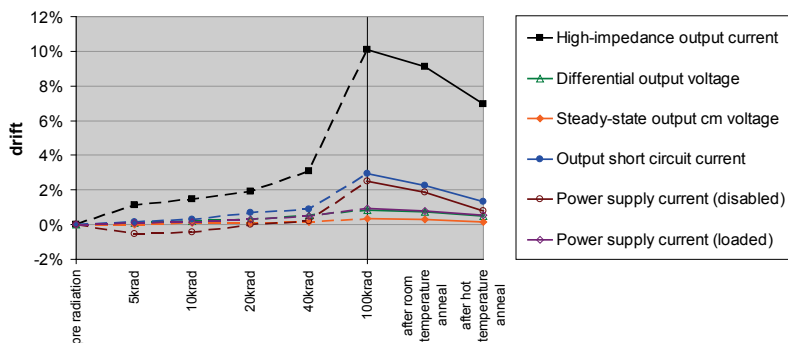
SPLVDS031RH

Conditions:

- TID without applied bias
- Dose rate: 75rad/min (^{60}Co source)
- Room temperature annealing
- Hot temperature annealing 100°C for 5h

Results:

- Minor shifts in key data sheet parameters after TID irradiation up to 100krad
- None of the specifications are violated
- All tested parts keep full functionality



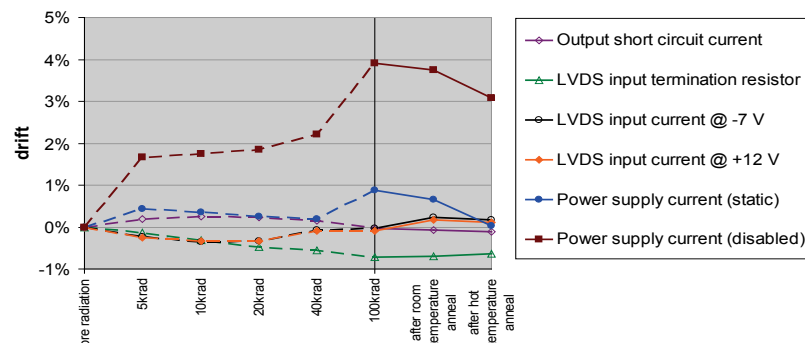
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- None of the specifications are violated
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SPLVDS031RH & SPLVDS032RH

Heavy Ions Test



SPLVDS031RH

Conditions:

- Static test mode #0
- LET 65.2MeV/(mg/cm²)

Results:

- No fails (SEL, SEGR, SEB)
- SET event - small variation of output magnitude (<100mV, 25ns)



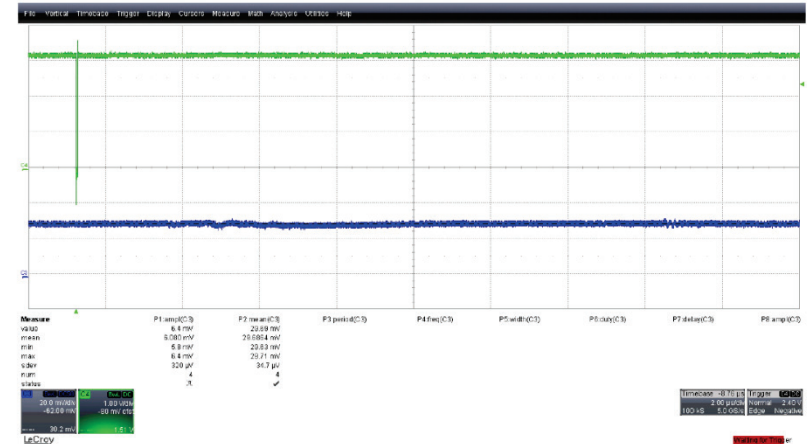
SPLVDS032RH

Conditions:

- Static test mode #0 (external fail-safe NW)
- LET 65.2MeV/(mg/cm²)

Results:

- No fails (SEL, SEGR, SEB)
- SET event - single bit error





New Developments

- Focus on general purpose ICs with significant quantities per satellite
- Based on SPACE IC technology and development portfolio:

Power Management, e.g.

- DC/DC Regulators
- LU Protection
- HV Gate Driver

Robust Interfaces, e.g.

- SpaceWire LVDS
- CAN Bus Line I/O
- CAN System IC

Share your requirements with our experts and define the next generation
ITAR/EAR-free space-grade product according to your needs.



***Thank you for
your attention!***

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