SPACE IC

Winner of the ESA
SME Innovation Award 2014

ESPC 2016

Efficient Secondary DC Power Distribution

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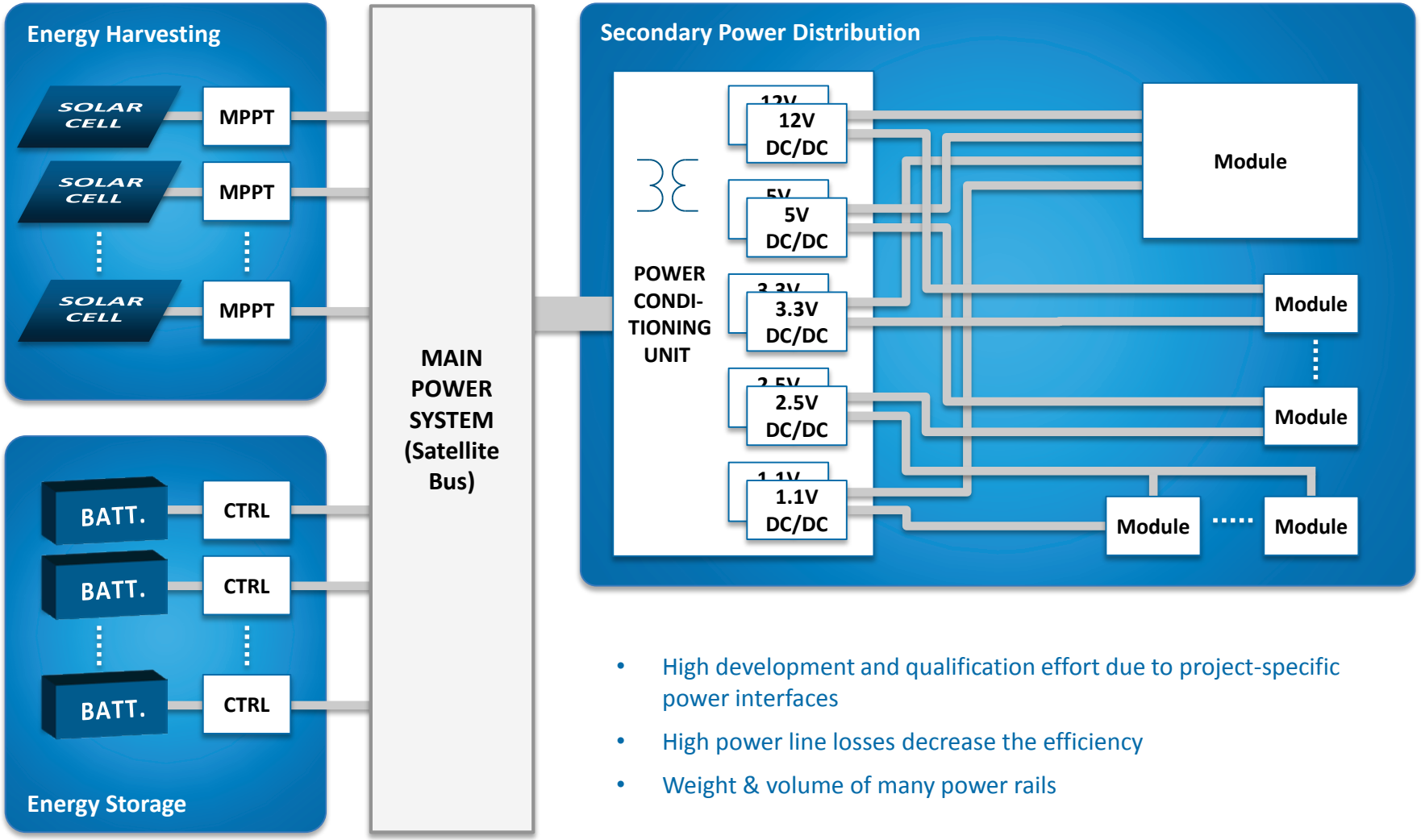
Overview

Efficient Secondary DC Power Distribution

- Custom Secondary Power Distribution
- Modular Secondary Power Distribution
- Requirements
- Point-of-Load Converter Solutions
- Outlook

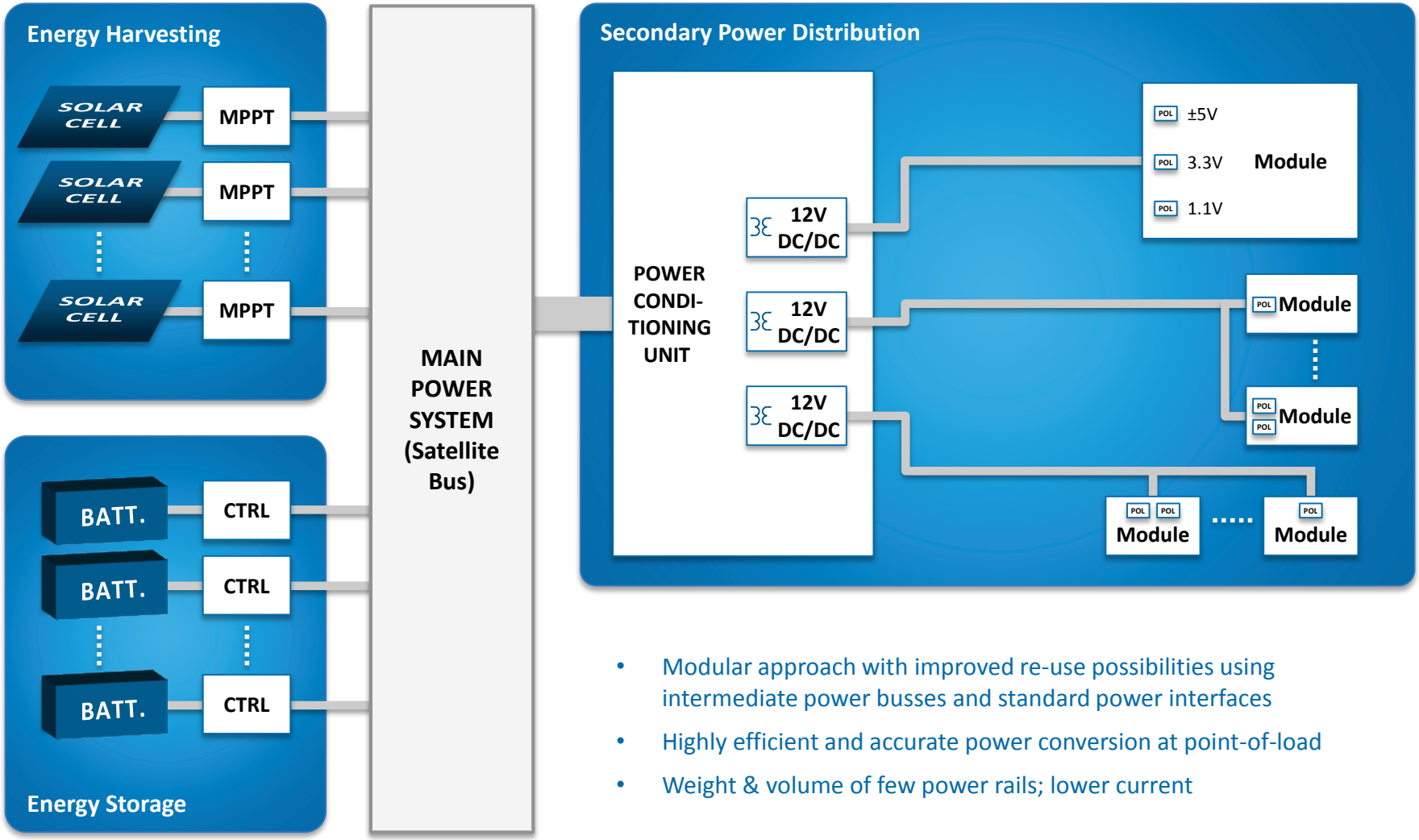
DLR newsletter COUNTDOWN, No. 29, Issue2/2015,
„Electronic Components: A Tiny Chip Manages Power Supply in Light-Weight Satellites“

Custom Secondary Power Distribution



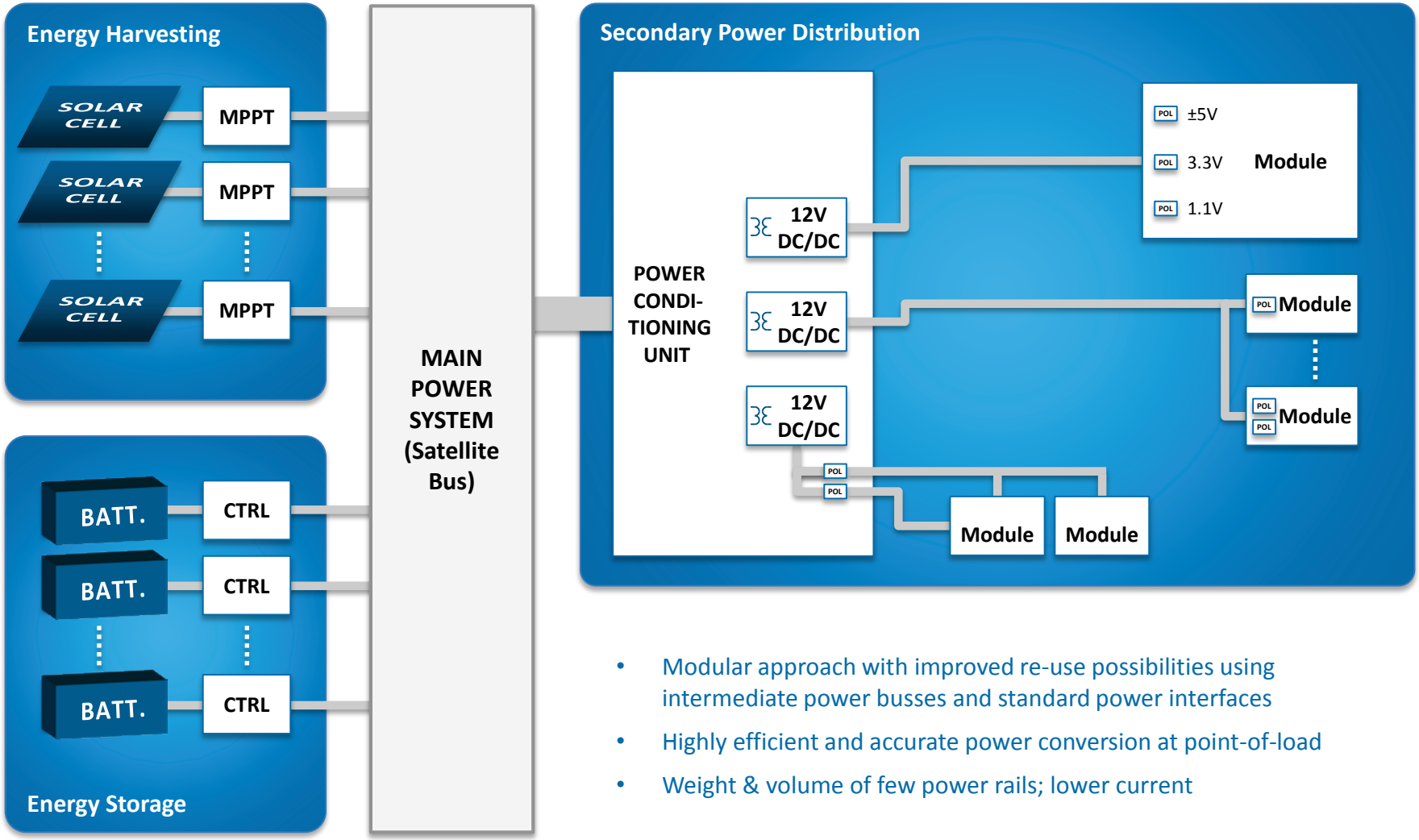
- High development and qualification effort due to project-specific power interfaces
- High power line losses decrease the efficiency
- Weight & volume of many power rails

Modular Secondary Power Distribution I



- 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

Modular Secondary Power Distribution II



- 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

Evaluation

Custom Power Distribution

- Established technology, but …
- Very complex and project specific secondary power conditioning
  - Multitude of voltages and power requirements
  - Precision requirements (even at severe load variations)
- Low voltages = high currents (conduction losses)
- Numerous power rails with large cable cross-sections (volume and weight)

Modular Power Distribution

Advantages

- Simplified secondary power conditioning by:
  - Few coarse voltages
  - Disentanglement from requirements of subsystems
- Flexibility and re-use by modularity and standardisation
- High efficiency due to low conduction losses and precisely fitting DC/DC conversion
- Significantly reduced volume / weight for power rails

→ **Cost-saving solution**

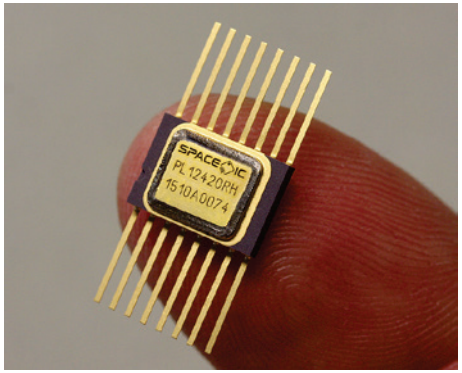
→ Requirements

- **Compact and efficient POL Solution**
  - Monolithic DC/DC converter IC with sufficiently high input voltage capability
- **Scalable power conditioning unit**
  - Reusable building blocks for various platforms
- **Standardisation of Intermediate Power Bus**
  - Standard power interface
  - Protective mechanisms
  - Filtering
  - EMI

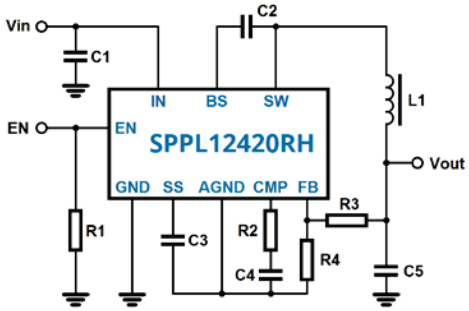
POL Solution SPPL12420RH

Features

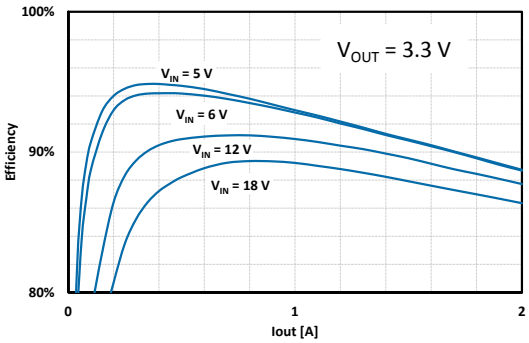
- Ceramic hermetic flatpack package
- Latch-up immune SOI technology
- 2A continuous output load current
- 4.5V to 24V input voltage
- 0.923V minimum output voltage
- >90% efficiency
- 340kHz fixed switching frequency
- ESD rating 4kV (HBM)
- -55°C to +125°C extended temperature range



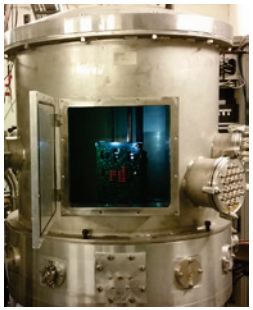
Application



- High-Density Point-of-Load Regulators
- Distributed Power Systems
- Intermediate Power Rail Architecture
- Satellite Systems
- Launch Vehicles



Radiation Hardness

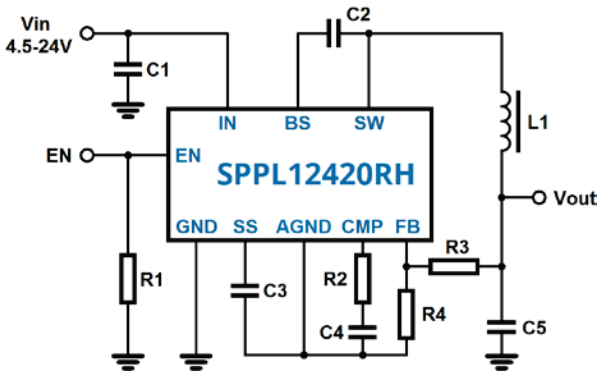


- TID > 100 krad (Si) - unbiased
- TID > 40 krad (Si) - biased

- SEL, SEFI and SEU immune
- Free from any destructive SEE at:
  - $V_{IN} \leq 11V$, LET ≤ 85 MeV·cm²/mg
  - $V_{IN} \leq 13V$, LET ≤ 60 MeV·cm²/mg
- SET-free at LET ≤ 35 MeV·cm²/mg
- No critical SETs at LET > 35 MeV·cm²/mg

Applications
SPPL12420RH

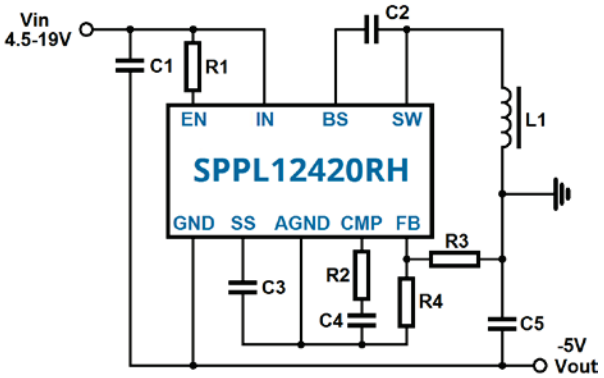
2A Application



$$I_L \leq 2A$$

$$I_{load} = I_L$$

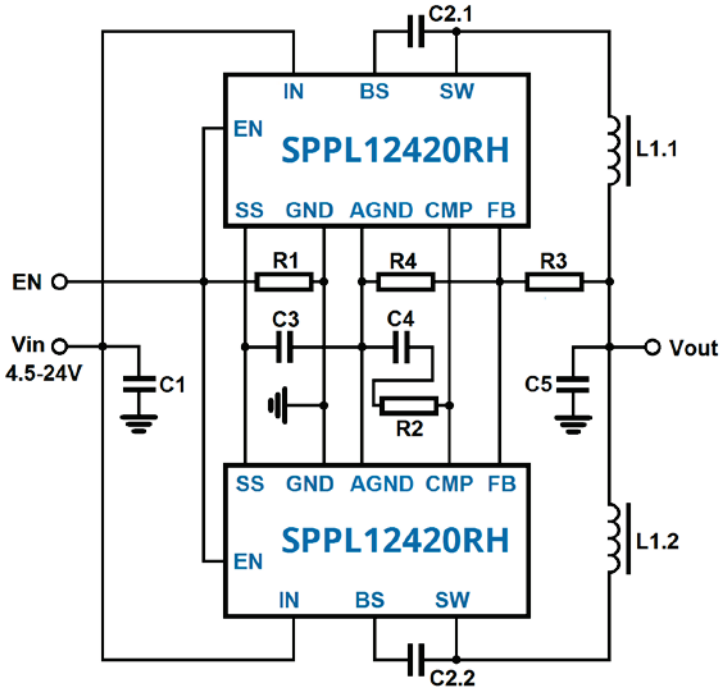
Negative Output Voltage



$$I_L \leq 2A$$

$$I_{load} = \frac{I_L}{1 + \left|\frac{V_{out}}{V_{in}}\right|}$$

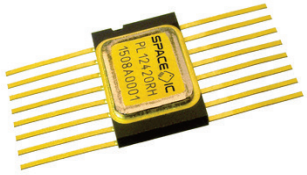
4A Load Sharing

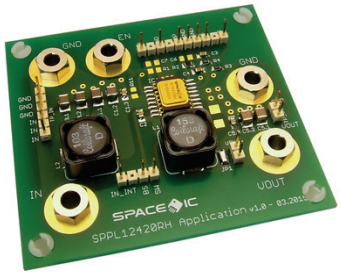


Status & Heritage
SPPL12420RH

Status

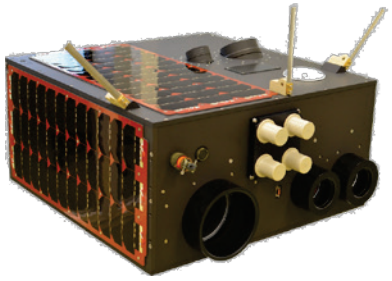
- Development _____ complete ✓
- Screening _____ complete ✓
- LAT Qualification Testing _____ complete ✓
- Engineering Models & EVKs _____ available ✓
- Flight Models _____ available ✓
- EPPL Listing _____ Jul 2016 ✓
- ESCC Certification _____ Q4 / 2017 ⌛





In-Orbit Demonstration

- Singapore earth observation satellite to support disaster monitoring in Asia
- Launched on December 16th, 2015 into 550km near equatorial orbit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- Telemetry data show persistent proper operation of the SPPL12420RH

Outlook

Cooperation

between **SPACE IC**

and **Manufacturers of Isolated DC-DC Converters**

Initiative "Standardisation in Secondary Power Conditioning"

- Standardisation of
  Intermediate Power Bus
- Development of a homogeneous solution for
  Secondary Power-Conditioning
- Using
  Non-isolated Point-of-Load Converters

SPPL14065RH

Next-Gen POL

- Monolithic POL-IC with significantly higher input voltage and load current capability

Target Features

- 40 V increased input voltage capability
- 3.3 V minimum input voltage
- < 0.8 V minimum output voltage
- > 6.5 A continuous output current
- Load sharing for > 2x 6.5 A load
- > 90% efficiency
- > 100 krad(Si)
- Latch-up immune
- Adjustable frequency
- Frequency sync, power-good
- For Intermediate Power Bus application

Schedule

- EM in 2018

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Thank you for your attention!

Please fill out our questionnaire!

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