

**A better way to deliver power for**  
High speed, low latency  
network coverage  
for the world

**VICOR**

# Powering LEO and MEO satellite networking ASICs

## High-performance connectivity

A satellite constellation with advanced communications technology has comparable latency to fiber and is capable of transporting multiple gigabits of network traffic to virtually any location. Bandwidth-intensive applications and the number of smart connected devices are rapidly increasing, requiring high-performance connectivity for businesses, ships, airplanes, autonomous vehicles and broadband Internet users, anytime and anywhere around the world.

## Need for better power delivery architecture

New LEO and MEO satellites are equipped with breakthrough digital payload electronics and require high-density, high-efficiency, low-noise power delivery networks (PDNs), particularly for their advanced networking ASICs. These power delivery solutions must also be tolerant to both TID (total ionizing dose) radiation and SEE (single event effects).

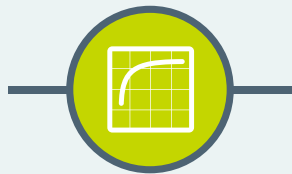
## Advantages of a better way to deliver power



Low noise



Factorized modular power architecture



High efficiency



High power and current density

# Vicor radiation-tolerant power solutions enable today's LEO/MEO satellites

## Ideal power delivery

Vicor radiation-tolerant power modules enable the ideal Power Delivery Network (PDN) for today's LEO and MEO satellites, providing high efficiency, high density, low-noise voltage conversion to power advanced network communication ASICs and processors.

## Performance and reliability

Power delivery performance and reliability are ensured by using proven topologies and Vicor standard CM-ChiP™ module construction on fully automated high volume lines in Andover, Massachusetts. Both TID and SEE radiation tolerance are ensured by careful component selection, qualification testing, and lot testing. Additionally, a dual power train fault-tolerant topology eliminates single event functional interrupts (SEFI).

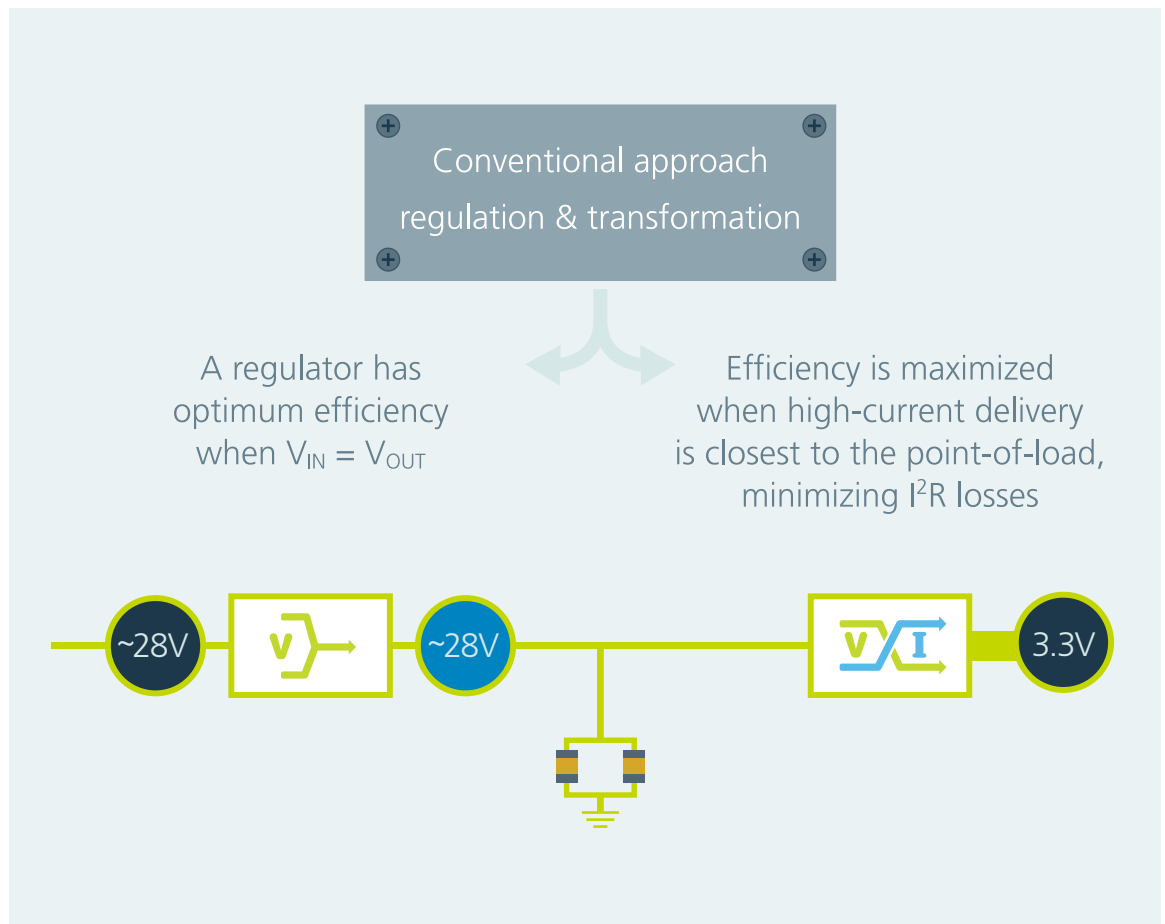
## Complete radiation-tolerant COTS solution

Providing complete source to point-of-load radiation-tolerant COTS solutions allow developers to reduce time to market and cost while maximizing board space utilization. Vicor power modules enable innovation in aerospace, defense, and supercomputing applications powering advanced communication arrays and the most advanced processors used for AI today.

## Proven and Trusted Supplier

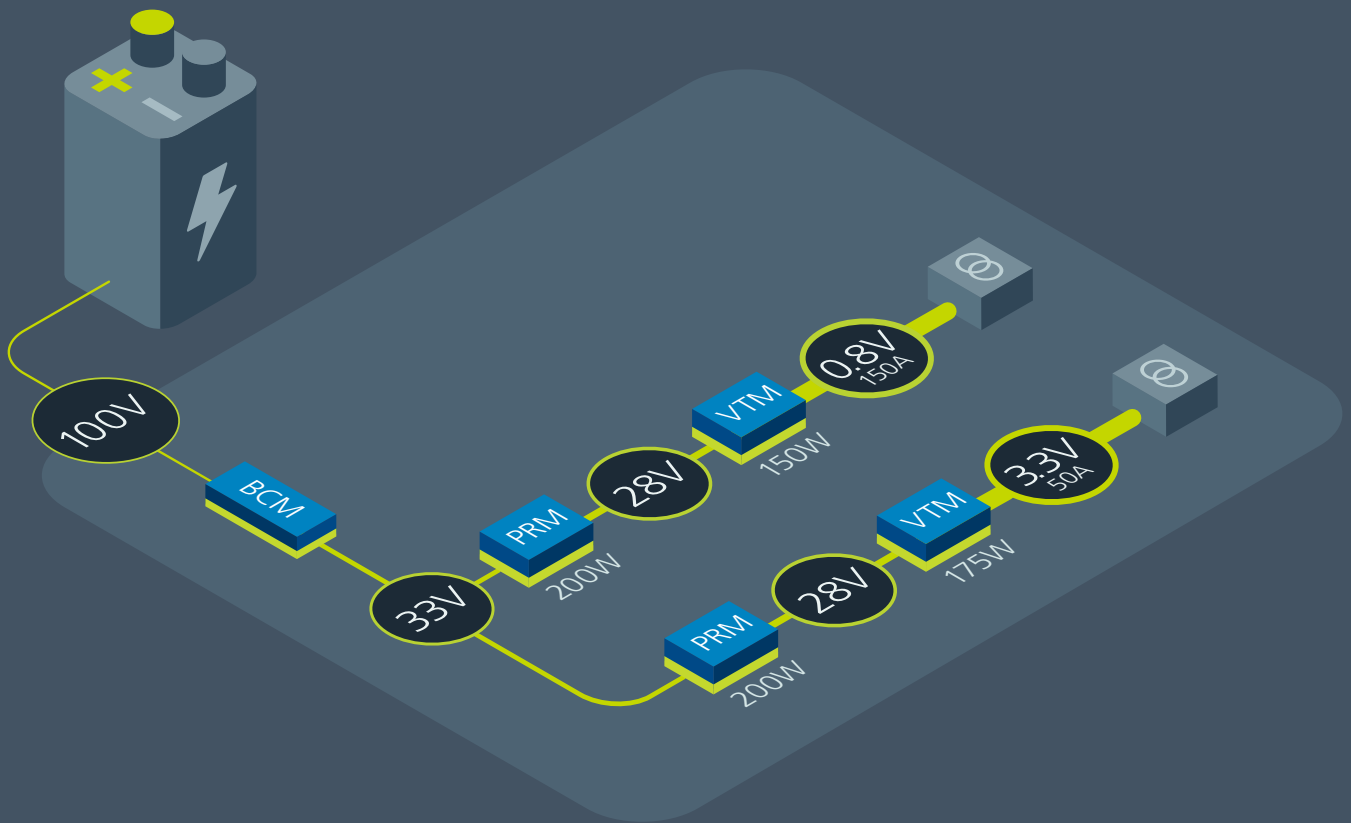
For over 40 years Vicor has designed and manufactured its innovative and award-winning power modules in the United States. Vicor recently expanded its manufacturing capability with the debut of the world's first ChiP (Converter housed in Package) fabrication facility, capable of manufacturing higher quality power modules faster and more efficiently. This new "ChiP fab" is vertically integrated enabling Vicor to have greater control of the entire manufacturing life-cycle process, thus reducing the risk of supply chain interruptions to our valued customers. To further ease the supply chain barriers for our international customers, Vicor rad-tolerant space products are all classified as EAR99 making them exempt from ITAR (International Traffic in Arms Regulations) restrictions.

# Vicor Factorized Power Architecture, the ideal point-of-load power system



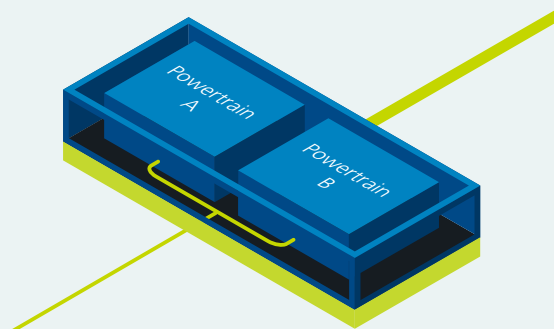
Factorized Power Architecture (FPA) factorizes power from the traditional single-function DC-DC converter into two distinct functions and power modules: a pre-regulation module, a PRM and a voltage transformation module, a VTM. The power switching topologies and control systems of each module are optimized for low noise and power losses, with zero-current and zero-voltage switching. The PRM and VTM components have high density, high efficiency, low noise operation and factorization allows the VTM to be placed close to the load minimizing board losses in high current applications.

# Example Power Delivery Network for LEO and MEO satellites



## A dual power train, fault-tolerant design

Single event functional interrupt (SEFI) immunity is achieved using a redundant architecture, where two identical and parallel powertrains with fault-tolerant control ICs are housed in a single, high-density SM-ChiP package.





## Products used in LEO/MEO power delivery networks



BCM3423 bus converter  
module

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Input: 100V (94 – 105V, 120V transient)

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Output: 33V (31 – 35V)

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Power: 300W

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Bus converter ratio:  $K = 1/3$

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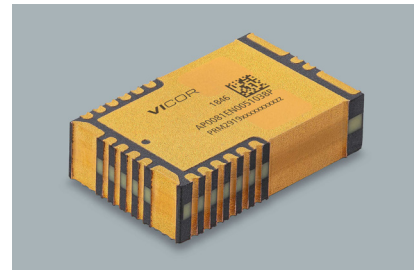
Typical full load efficiency: 96%

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33.5 x 23.1 x 8.0mm, 25.9g

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50k rad, 35 MeV-cm<sup>2</sup>/mg



PRM2919 regulator  
module

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Input: 33V (30 – 36V)

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Output: 32V (13.4 – 35V)

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Power: 200W

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Current:  $I_{OUT}$  8A max

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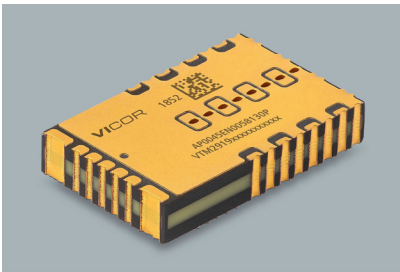
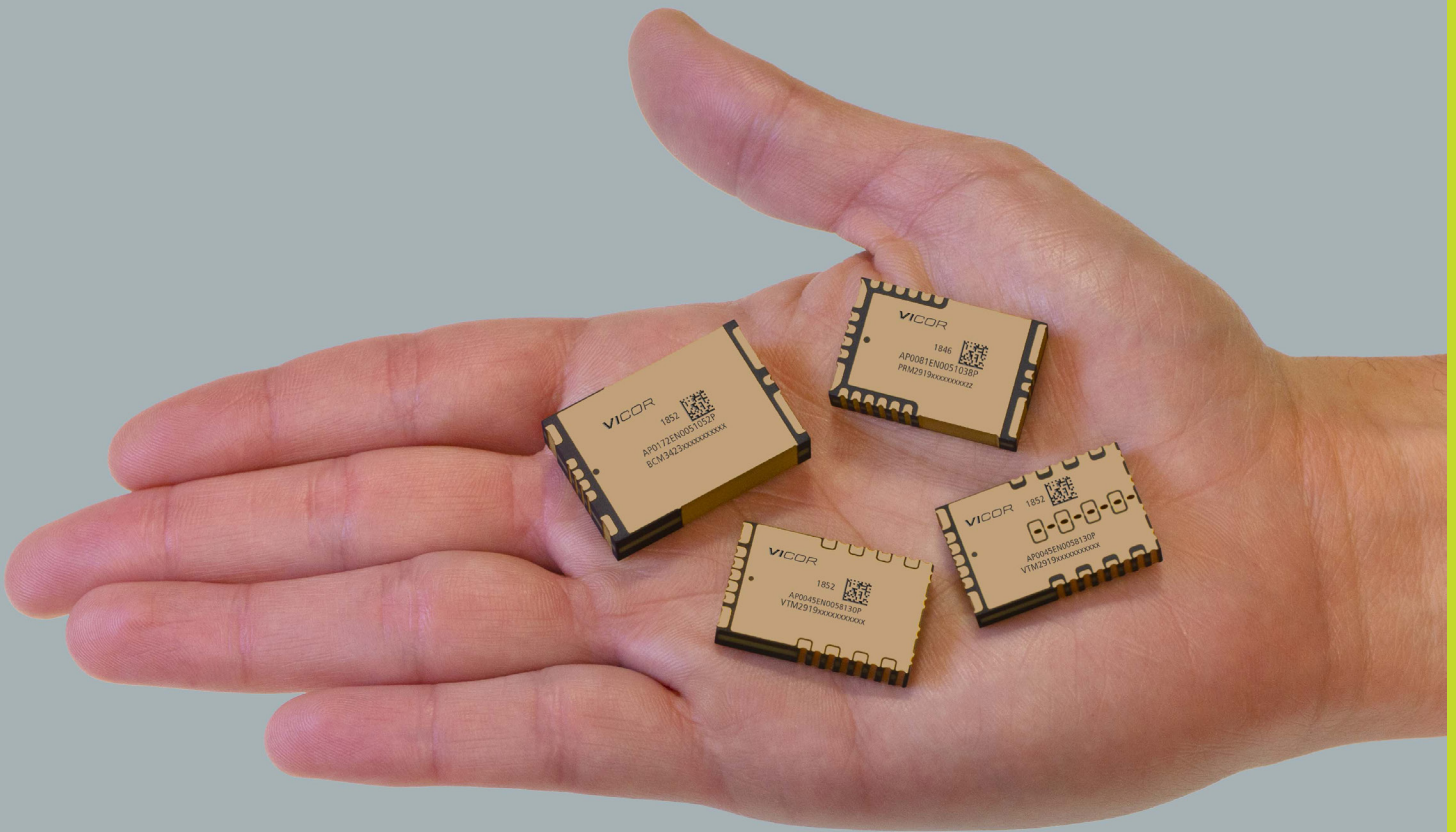
Typical full load efficiency: 96%

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29.2 x 19.0 x 8.0mm, 18.2g

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50k rad, 35 MeV-cm<sup>2</sup>/mg



VTM2919 0.8V, 150A voltage transformation module

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Input: 13.4 – 35V

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Output: 0.42 – 1.1V

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Power: 150A

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Converter ratio:  $K = 1/32$

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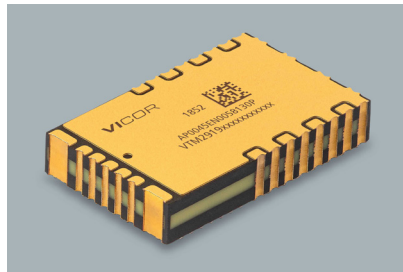
Typical full load efficiency: 92%

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29.2 x 19.0 x 5.5mm, 13.3g

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50k rad, 35 MeV-cm<sup>2</sup>/mg



VTM2919 3.3V, 50A voltage transformation module

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Input: 16 – 32V

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Output: 2 – 3.8V

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Power: 50A

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Converter ratio:  $K = 1/8$

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Typical full load efficiency: 94%

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29.2 x 19.0 x 5.5mm, 11g

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50k rad, 35 MeV-cm<sup>2</sup>/mg

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Compact, high-density, high-efficiency-DC-DCs for New Space applications

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High-density power is needed to keep pace with projected 20X growth

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Radiation-tolerant power electronics key to filling satellite infrastructure gap

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Glossary of terms for commonly used space and satellite terminology

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