High density power conversion accelerating the migration to 48V power delivery networks

Our high performance power modules enable…

Breakthrough AI processing performance

Range-extending 48V architectures in electric vehicles

Advanced mission-critical functionality and data transmission

Automation, autonomy and electrification for Industry 4.0

High performance computing

Automotive

Aerospace and defense

Industrial

The journey of 48V power delivery networks

Communications: The first to use 48V to decrease power losses over long distances

↓

High performance computing: Adopted 48V in multi KW racks for High Performance Computing

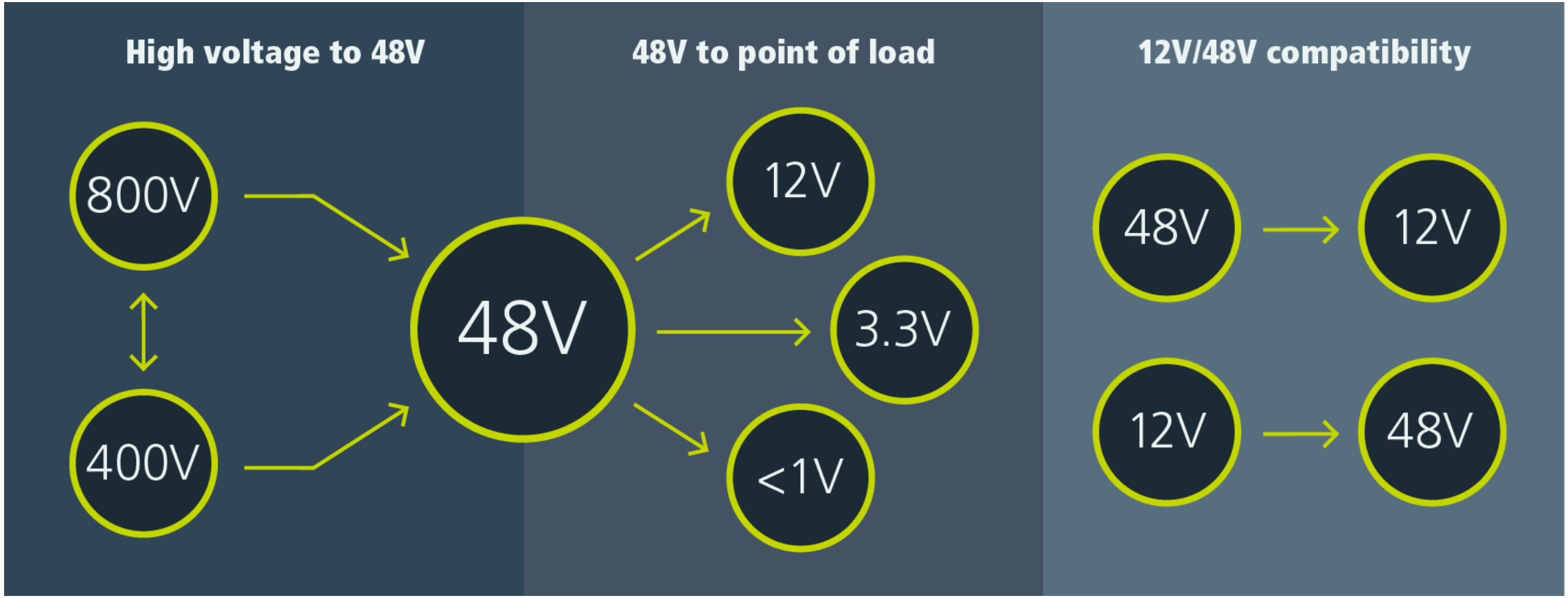
↓

Automotive: Migrated to 48V to reduce the power cable weight in EVs

→

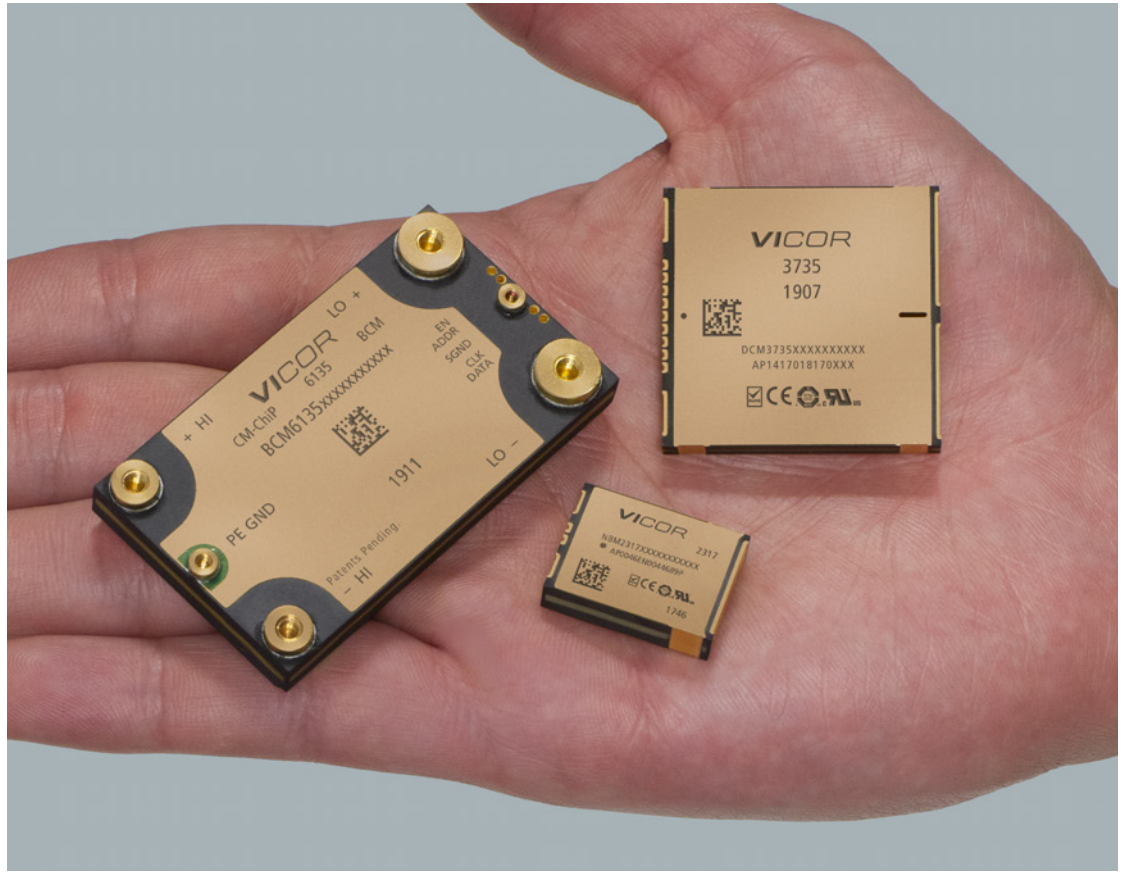
Industrial applications are now transitioning to reap the benefits of 48V PDN's

Unique portfolio of 48V products

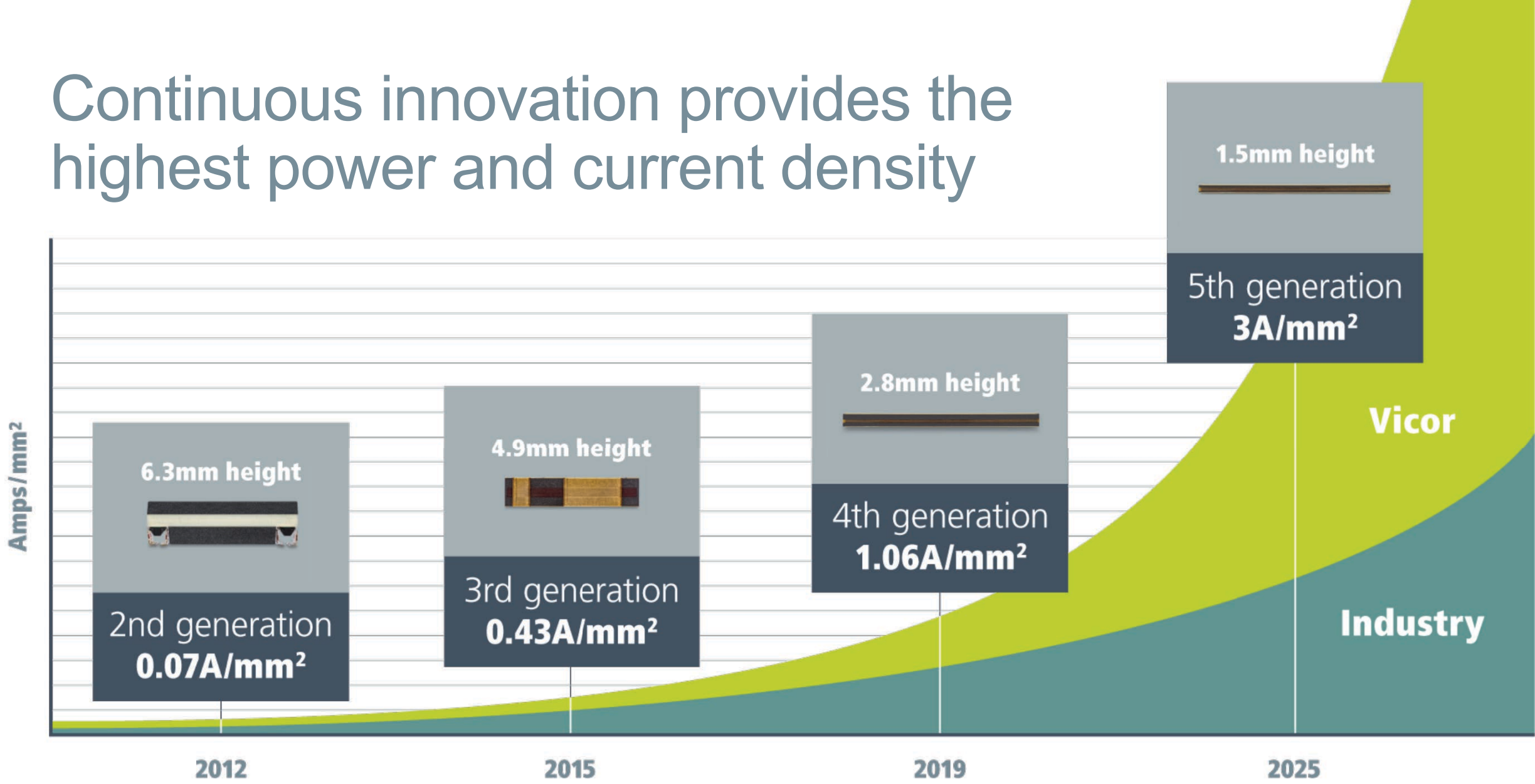


48V high performance power modules

- Supporting the entire 48V power delivery network:
  - High voltage to 48V
  - 48V to point of load
  - 48V/12V compatibility
- Up to 30kW/in^3 power density
- Solving the toughest problems
- Enabling quick design and prototyping of 48V PDNs

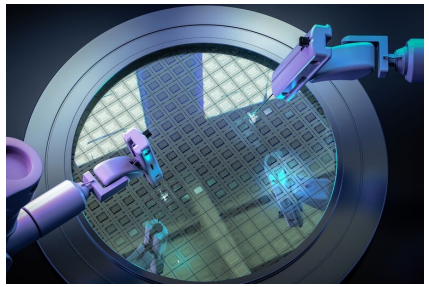


Continuous innovation provides the highest power and current density

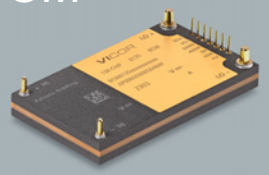


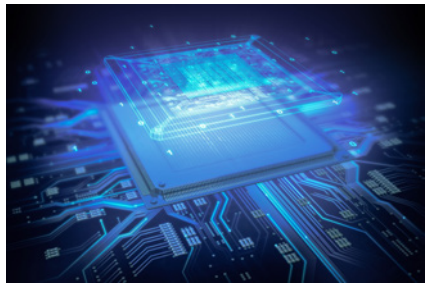
Scaling our investments in HPC and automotive

PRM and VTM

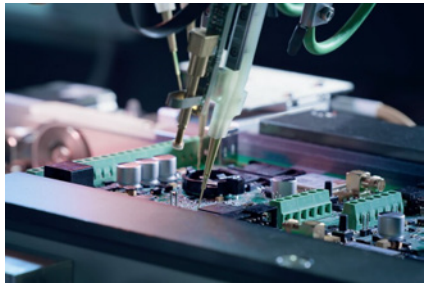


BCM





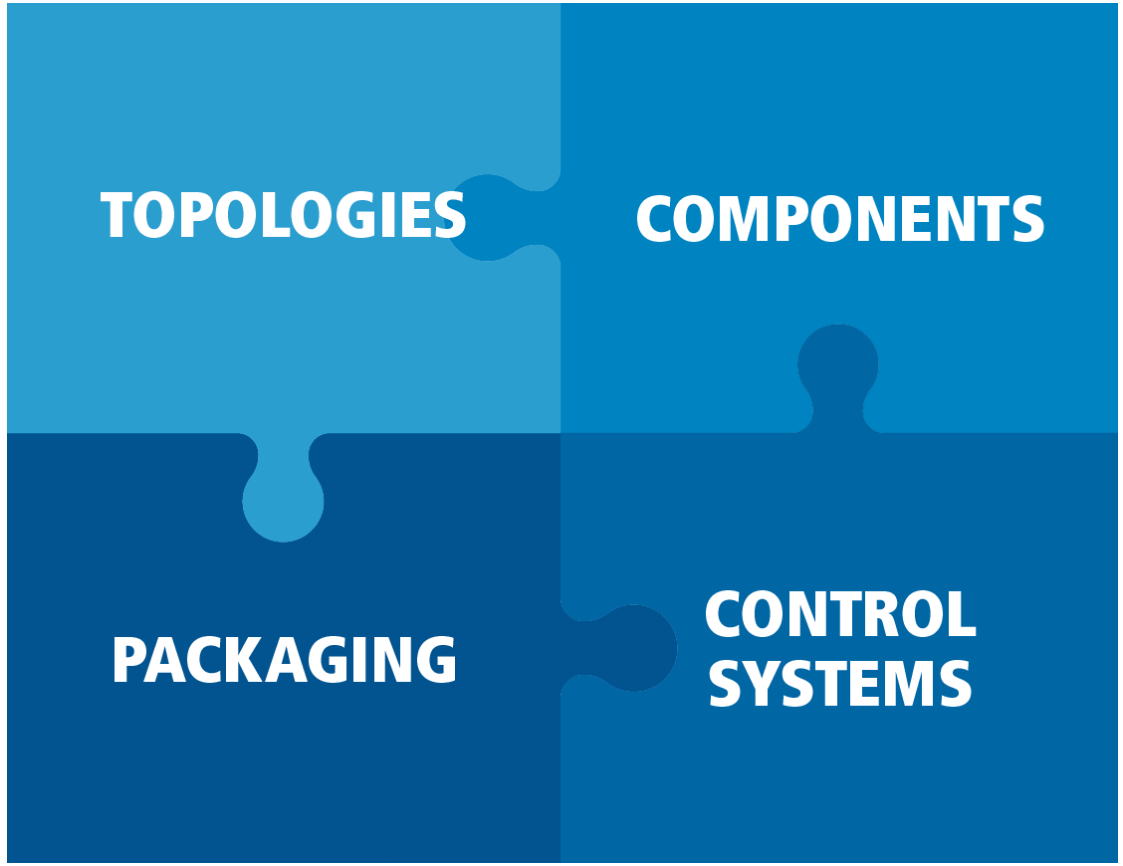
DCM



A growing IP licensing practice

Enables resilient, scalable supply chains for OEMs

- IP license available for all patents
- Protection from importation bans or injunctions
- Strong incentive to purchase from Vicor via royalty reduction rates

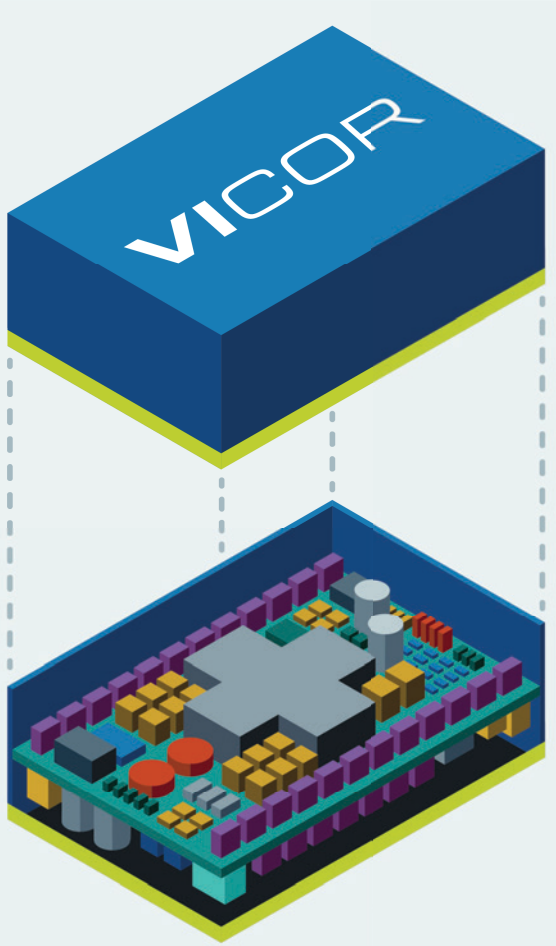


High performance power modules

Power modules

- Compact, lightweight and up to 10x the power density of other solutions
- Simplifies power system and thermal management design
- Fully tested and ready to implement

Anatomy of a power module

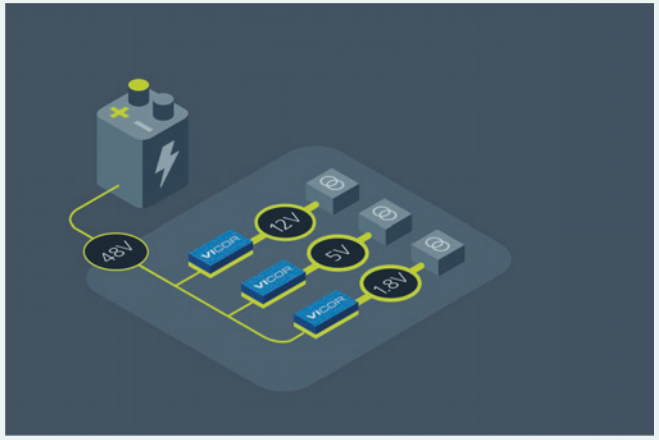


Extended variety of input and output voltages available

Isolation, regulation, conversion and voltage transformation integrated in different combinations

Hundreds of components are tightly arranged within a miniature footprint

Simpler strategy and implementation



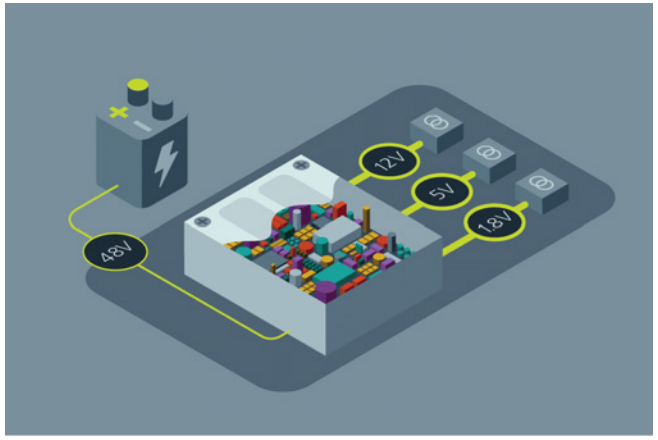
Simple, modular approach

- Up to 10x power density
- Uses less board space
- Simplifies thermal management
- Flexible and scalable
- Simplifies system design

VS

Complex discrete solution

- Requires considerable expertise
- Needs hundreds of components
- Change is difficult and risky



Inflexible silver box

- Adding loads, changing power or voltage levels is not practical
- Susceptible to noise and external interference

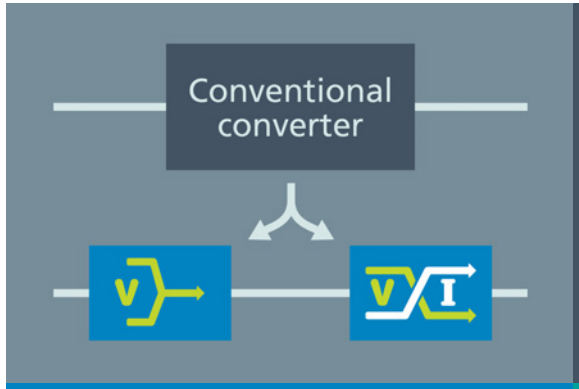
Innovation on many fronts

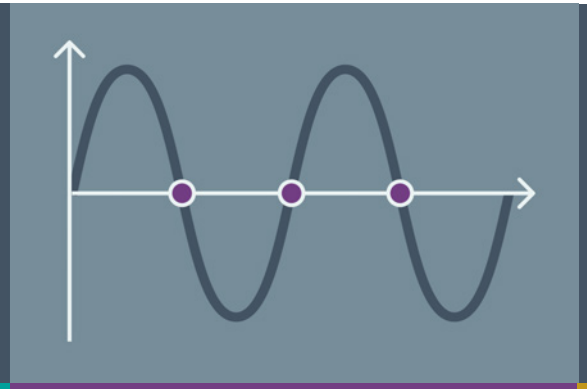
Factorized power reduces power loss on the intermediate bus

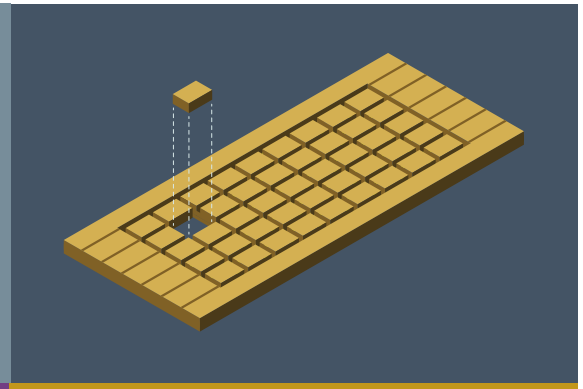
Sine amplitude conversion eliminates wasteful energy storage

Low-noise zero voltage switching performs at high frequency without sacrificing efficiency

Patented fabrication processes enable the highest density and continued innovation







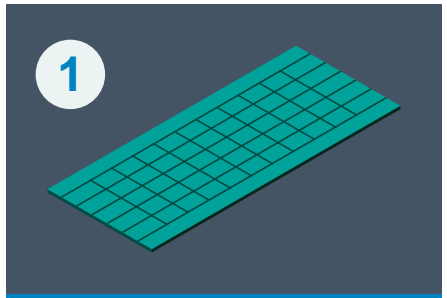
New approach to power delivery architectures

Power conversion topologies

Control systems

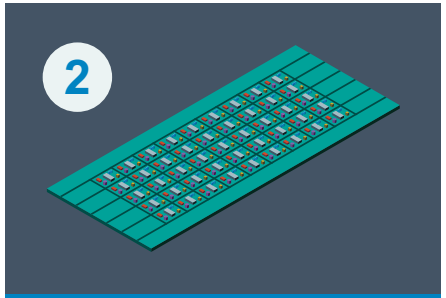
Proprietary packaging

Proprietary packaging process



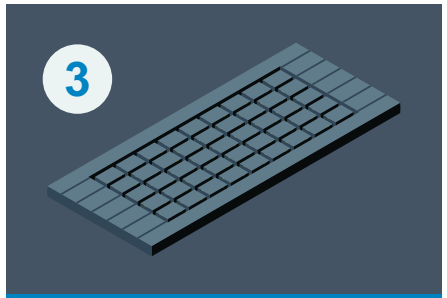
Bare panel

The process begins with a bare panel, ready for multiple instances of the same high-performance module, analogous to a silicon wafer



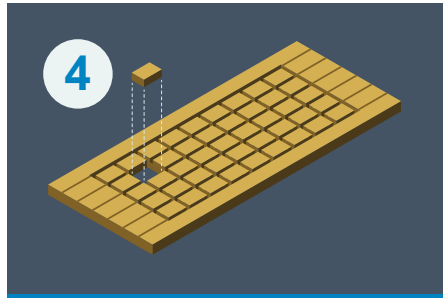
Surface mounting

High-quality power components, including magnetics, are mounted and soldered via state-of-the-art pick-and-place tools



Overmolding

A plastic compound encases the panel, protecting the components and creating a flat surface that makes the final product easier to handle



Plating

Heat conducting metals are plated onto the panel to enable a thermally efficient and reliable finished product

CHiP modules

The panels are singulated into individual modules and tested for conformance to data sheet specifications

Vertically integrated manufacturing in Andover, MA

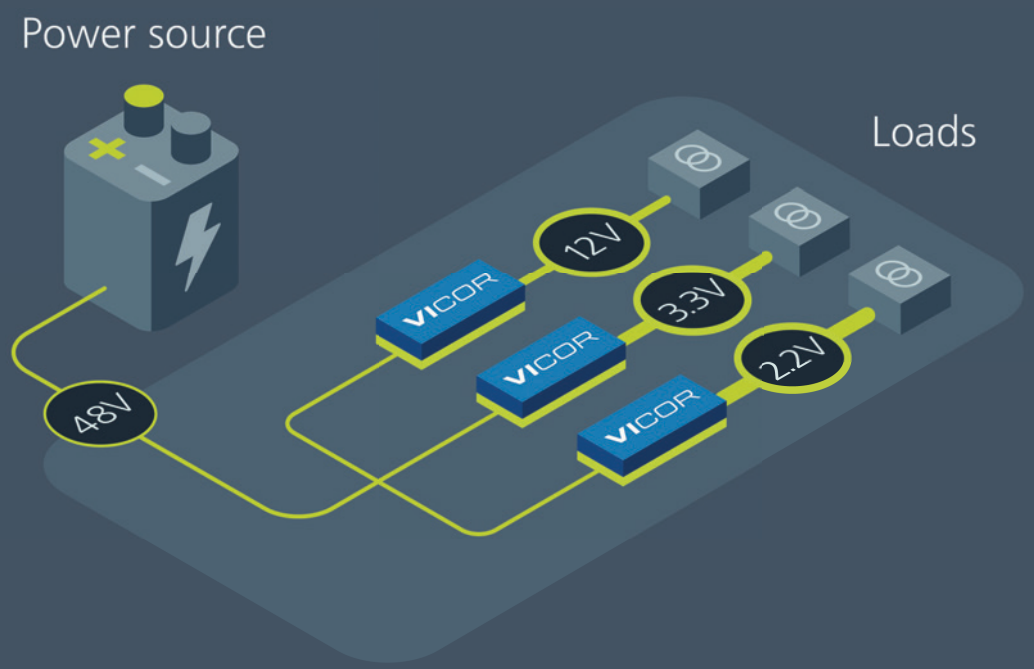
- The higher performance of our power modules comes from a combination of design engineering and patented fabrication processes
- Manufacturing and engineering co-located to foster collaboration and continued innovation
- Increased control and oversight on product quality and cycle times
- $1B+ Capacity

Solving the toughest power challenges

Modular power delivery networks

- Easier and simpler to design and implement
- Easily adaptable to changing power requirements
- Reduced time to design completion vs. designing and testing a discrete PDN
- Reduced space and weight

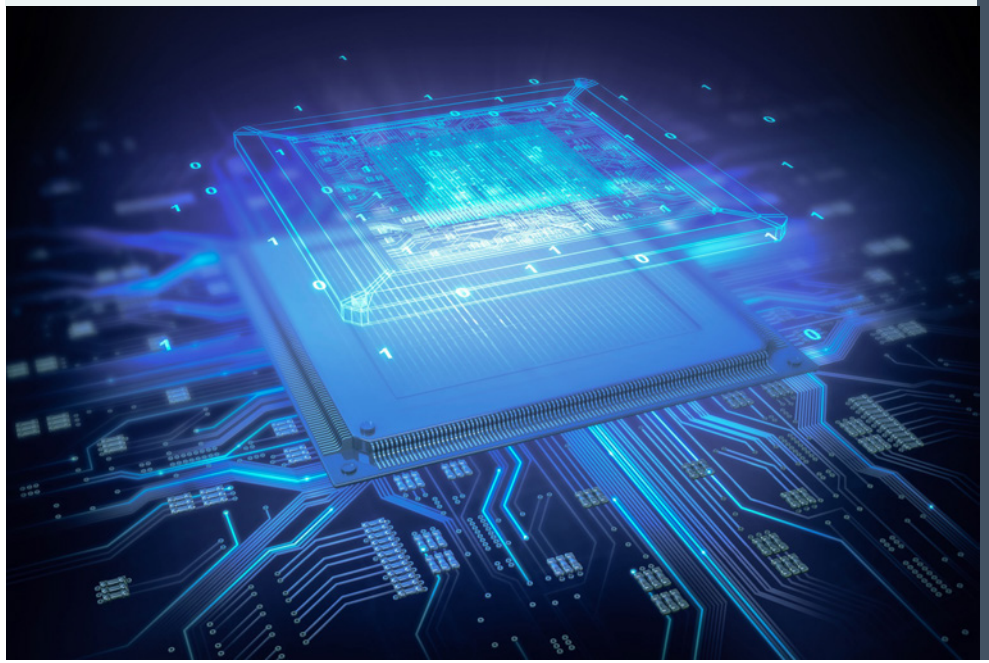
Anatomy of a power delivery network

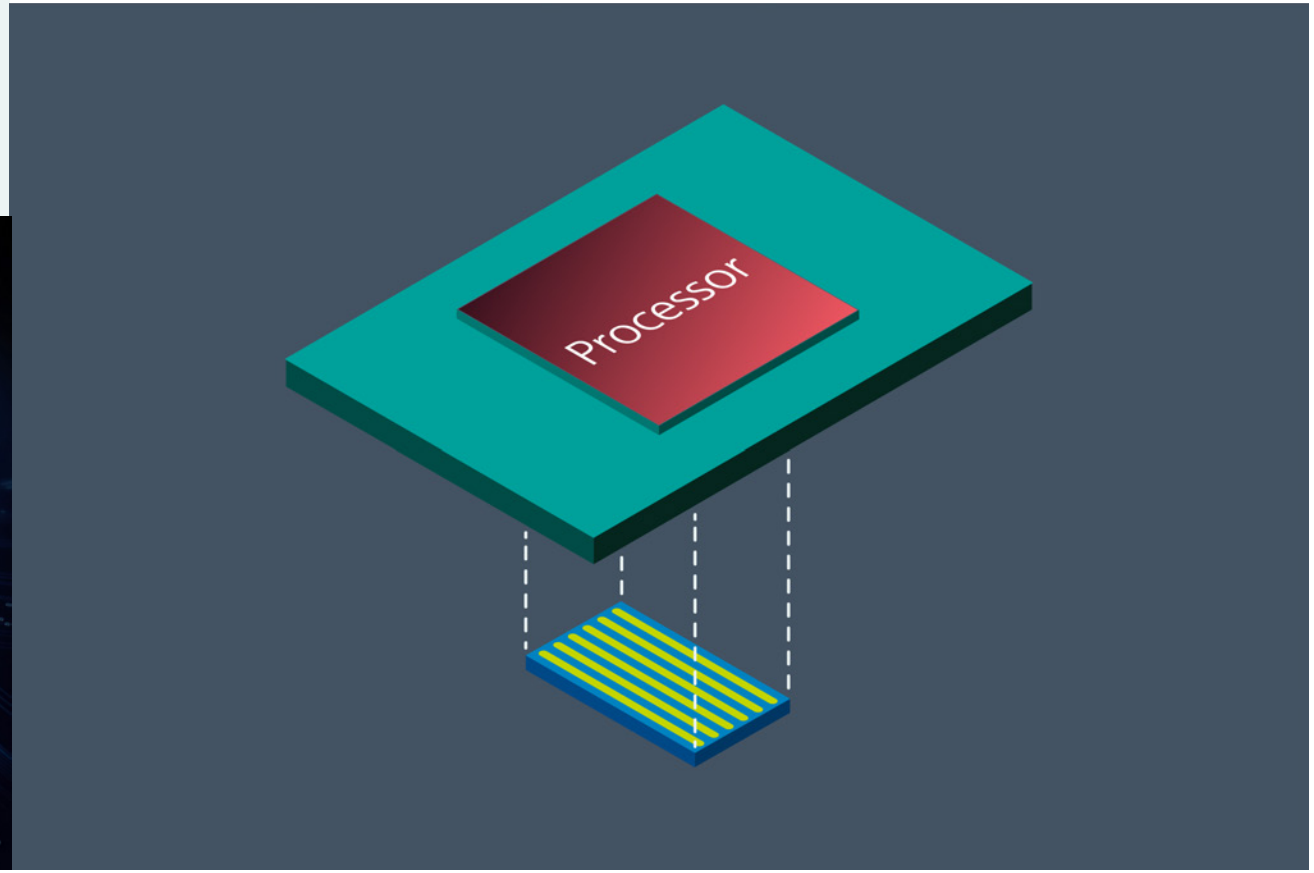


How Vicor power modules are arranged to deliver power

Computing case study – Vertical power delivery

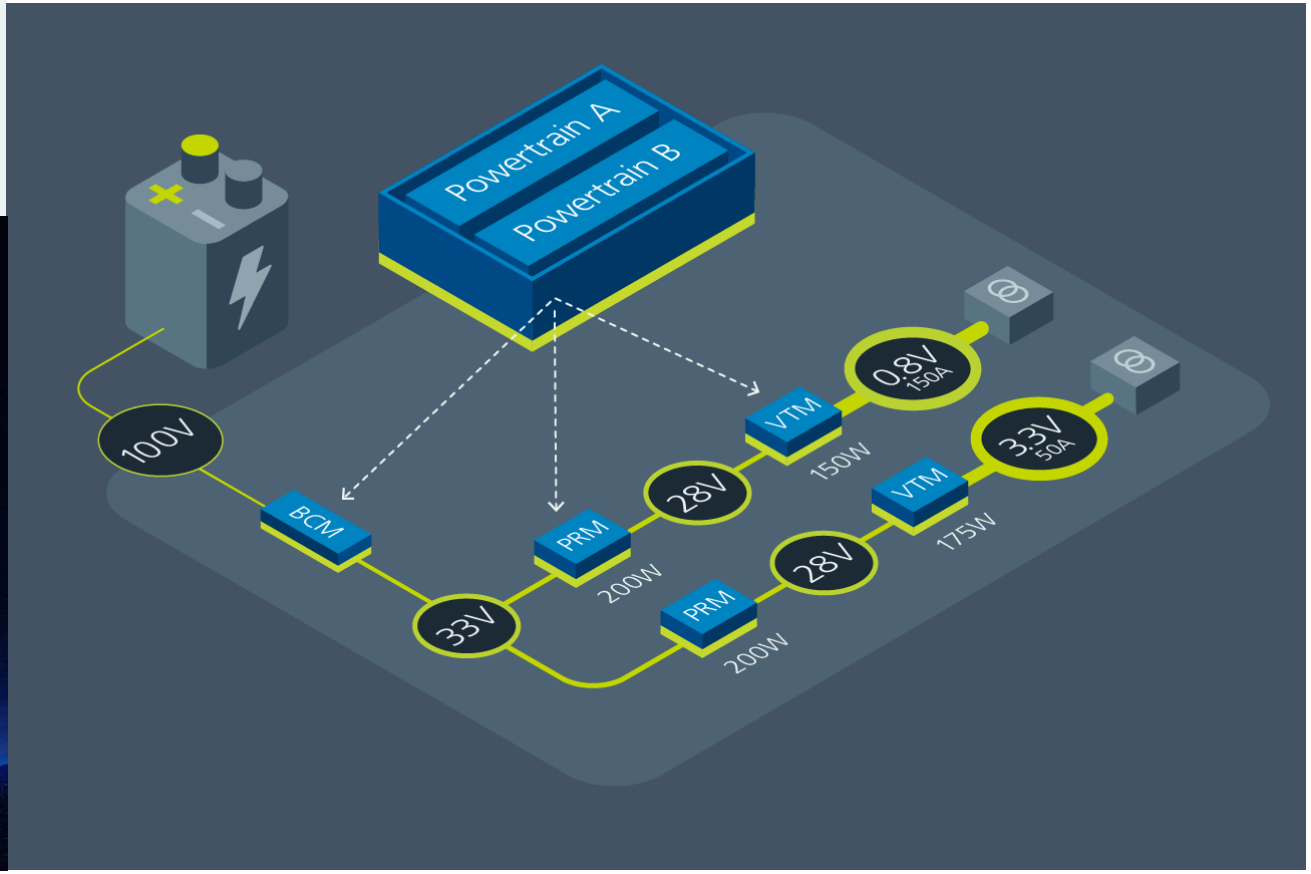
High current delivery placed right below the processor helps data centers reach their optimal AI potential





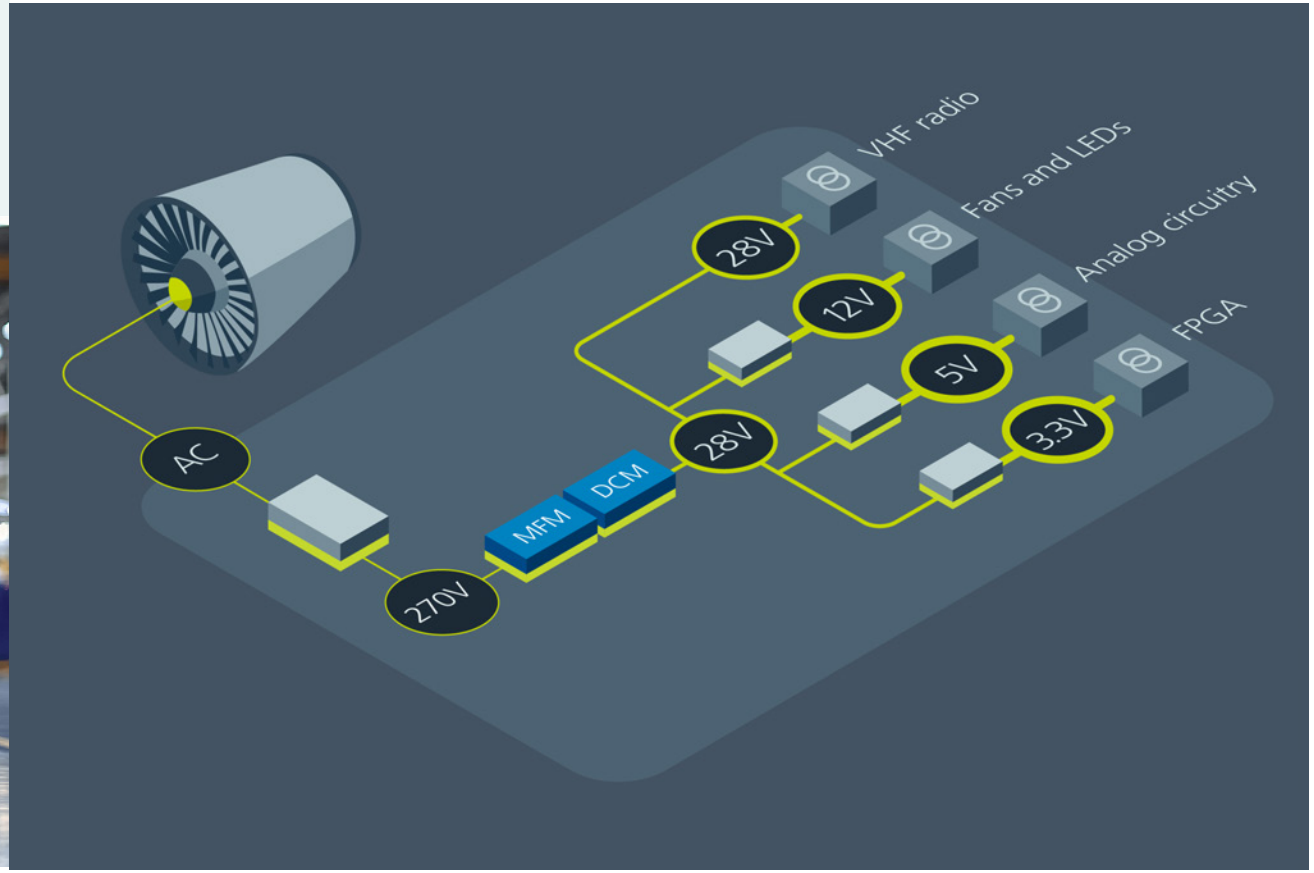
Satellite case study – AI processing on orbit

Compact, redundant power enables advanced processors to provide real time, on orbit decision-making



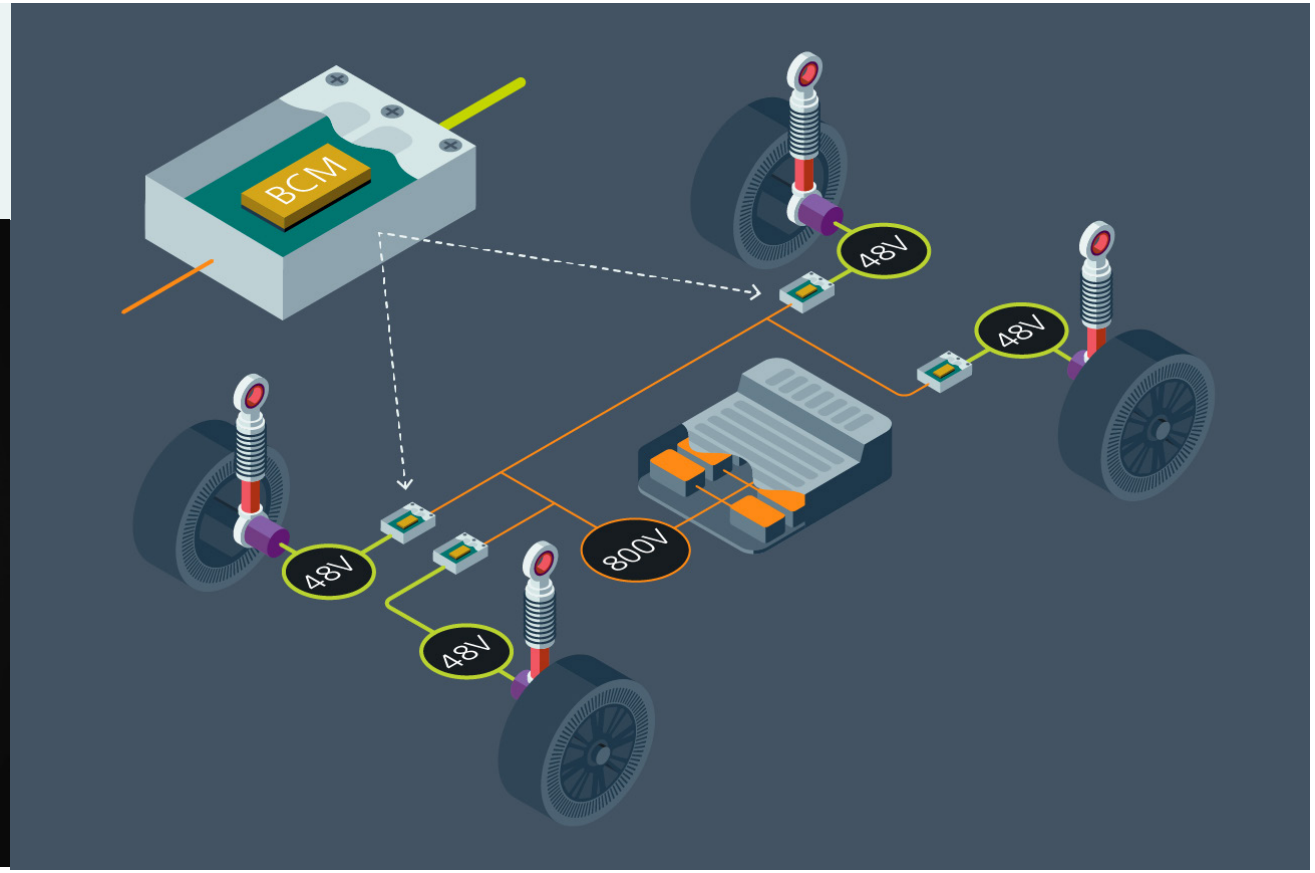
Defense case study – Airborne 28V bus

Unrivaled power density provides a groundbreaking, lightweight solution for powering airborne systems



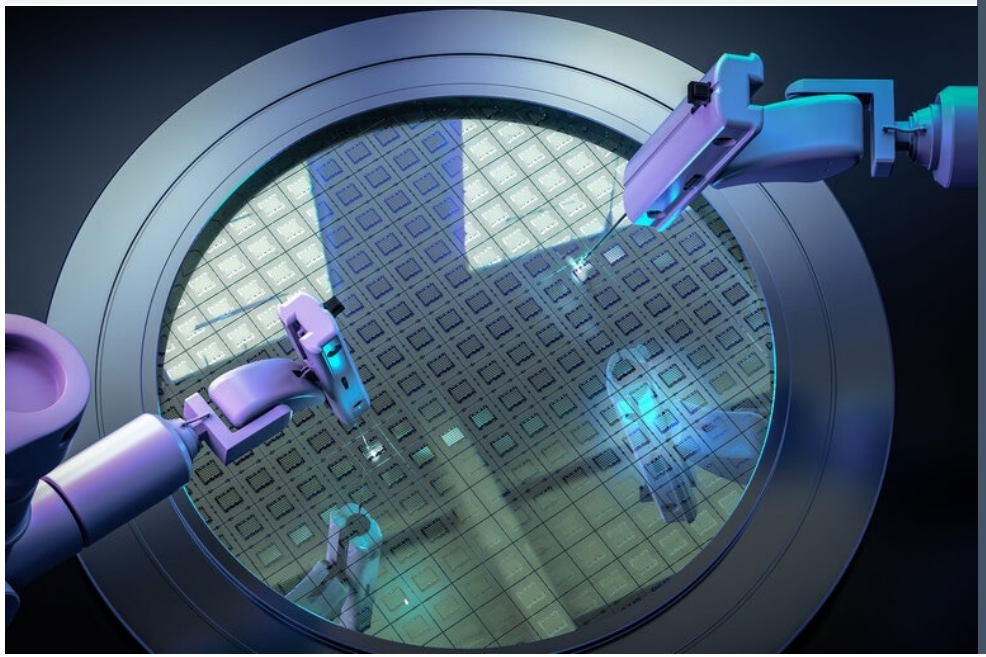
Automotive case study – EV active suspension

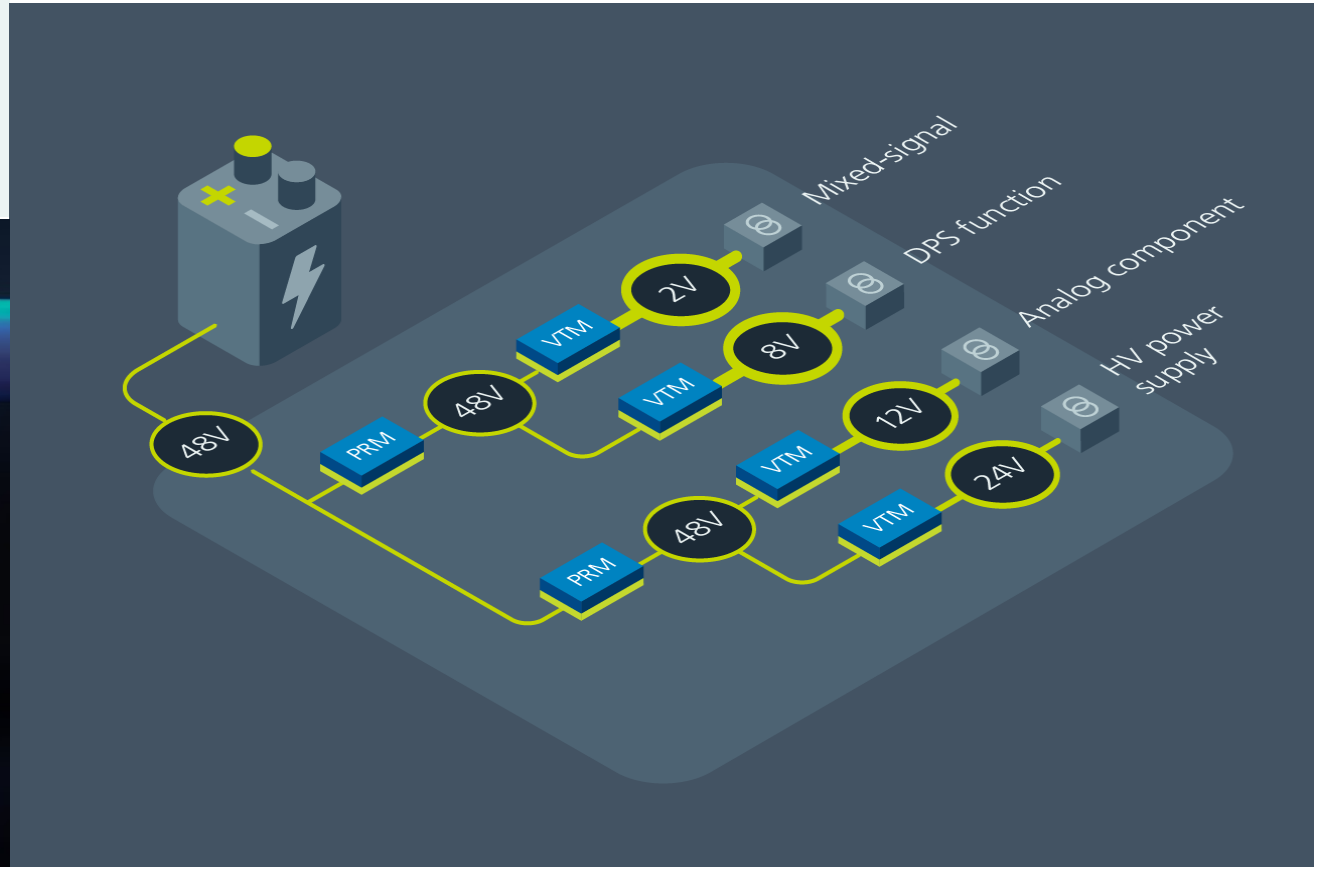
Transient response and density of the Vicor bidirectional modules make active suspension viable for broader use



Industrial case study – Test equipment

Low EMI noise and scalable power enables increased testing throughput and accuracy





Financial information

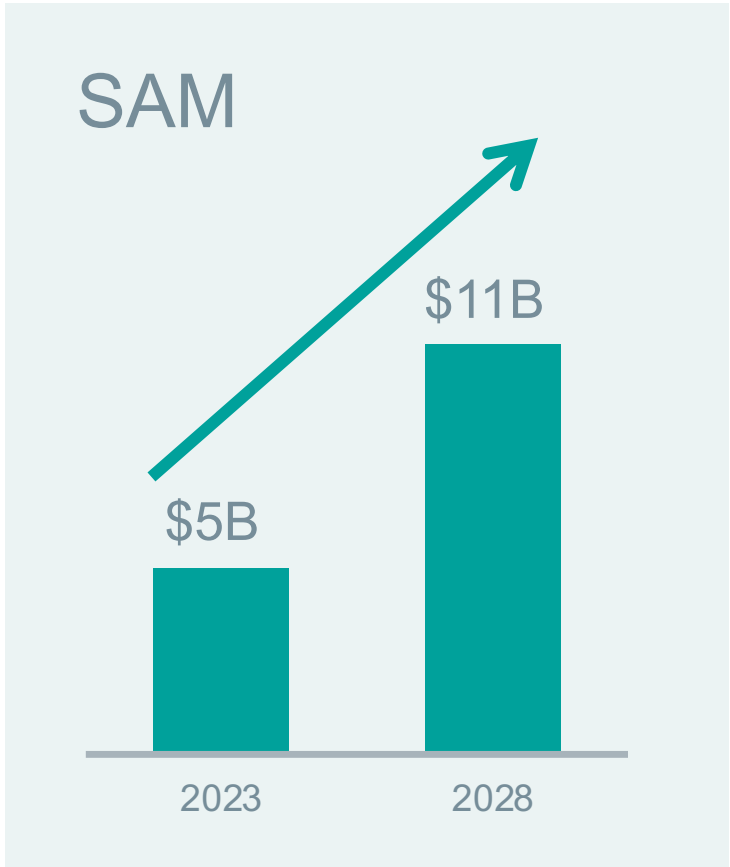
Corporate strategy

- Focused on our Top 100 accounts across four markets
- Channel driven broad market
- Customer defined excellence
- Vertically integrated ChiP fab
- Proprietary technology leadership in 48V power
- IP licensing practice

SAM across four target markets

High Growth Power Delivery Networks (PDNs)

- Vertical Power Delivery
- 800V to 48V PDNs
- 48V to 12V PDNs
- AC-DC 400Hz PDNs
- Radiation tolerant FPA PDNs
- VITA/SOSA standard rack modules



Balance sheet strength

- Operating cash flow funds operating requirements
- No debt on the balance sheet
- First phase capacity expansion and investment complete
- Capacity in place to scale to $1B annual revenue
- Selective share buyback program

Thank you