VICOR

VICOR High Performance Power Module

Power the Edge Computing

Vicor Taiwan FAE

Marco Hsieh

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Contents outlines

- Vicor company introduction
- Edge computer new trend and power requirement
- Concerns for power deliver and efficiency for next gen edge computer
- Vicor advantage SAC transforming power delivery
- Vicor new generation power modules comparison with legacy bricks
- Success story sharing

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Vicor snapshot

- Headquartered in Andover, MA USA
- Found in 1981
- Public since 1990 (NASDAQ: VICR)
- 170+ patents, $400M invested in proprietary power distribution architectures, power conversion topologies, control systems, and packaging technologies
- 1000+ staff, 10,000+ customers
- Proven leadership on power conversion
- www.vicorpower.com

Headquarters at 25 Frontage Street

Technical Sales Center (TSC) Locations

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Our high performance power modules enable…

Breakthrough levels of 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

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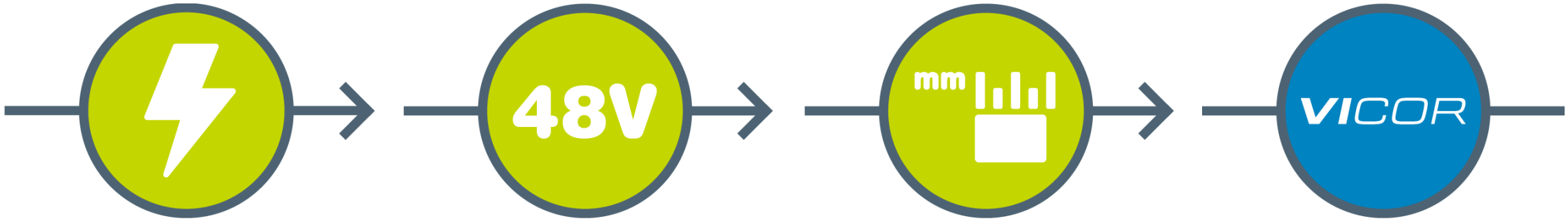
Vicor: modular Power Delivery Networks (PDN)



System performance demands driving rapidly increasing load power

PDNs moving to higher voltages in a number of high growth markets to ease the delivery and distribution of higher power

Power = Voltage x Current

High-density, modular power delivery solutions:

Scalable

Flexible

Repeatable

Proven

The power module company with the highest performance and density

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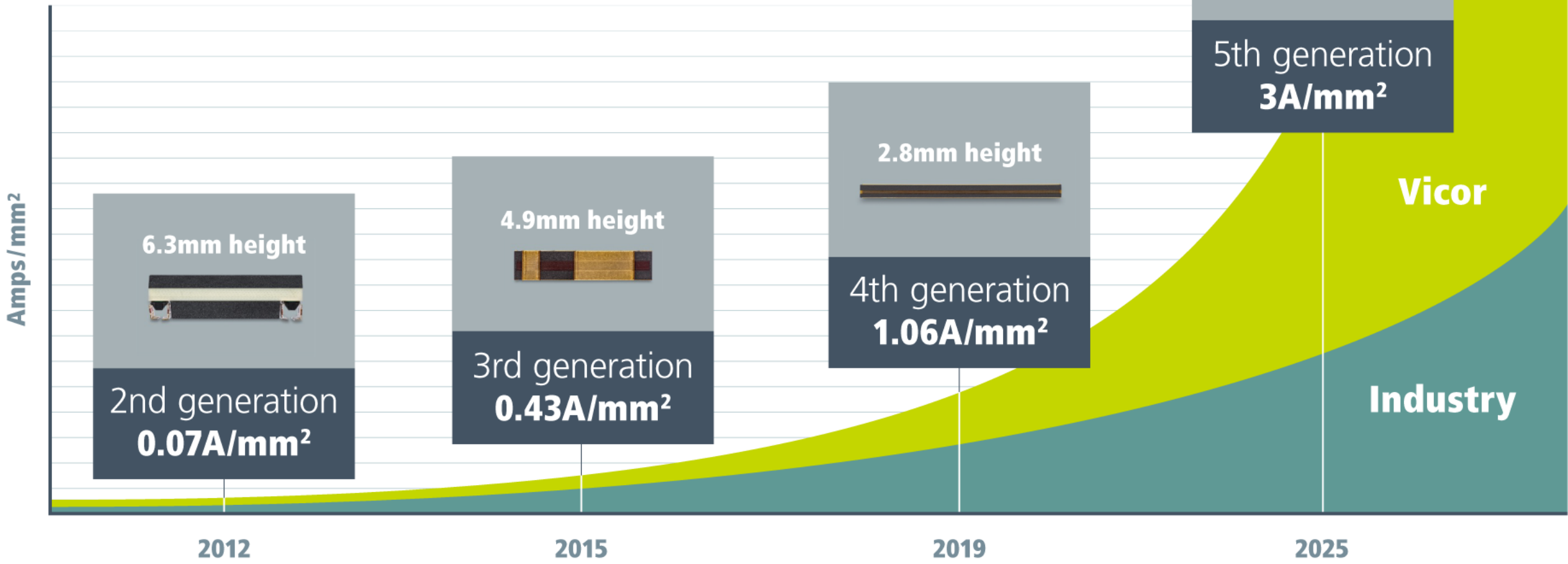
Continually providing the highest density power solutions



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Higher efficiency and higher power density

- Provide highest power density converter
- Vicor products and applications
  - Edge computing & embedded computer
  - Clouding training AI Accelerate module & HPC or data center
  - 4G/5G and new 6G telecom instrument and core switch
  - High reliability ATEs, AI robotics
- More flexible than legacy PSU, and fast to production than discreet solution
  - Scalable power architecture with redundancy
  - Simple thermal management
  - Tailored solutions

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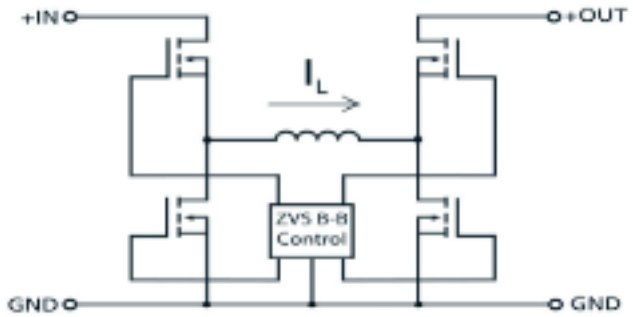
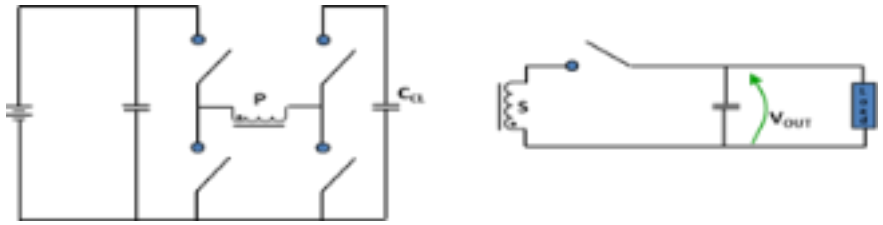
How Vicor Does it High Density, High Efficiency, Lighter Weight, Low Noise

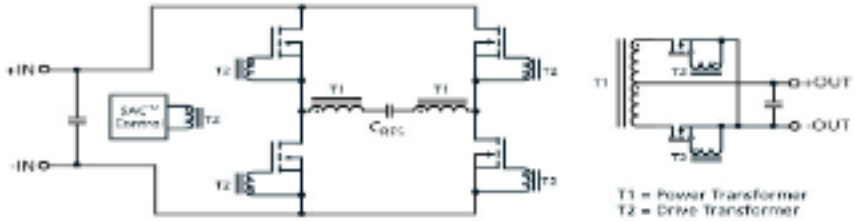
- Topologies
- High frequency switching
- Planar magnetics
- Semiconductor integration
- Modular, 3D packaging
  - Unmatched from factors
  - Superior thermal and EMI characteristics
  - Design flexibility



ZVS Regulator
Non-isolated, DC-DC regulator



Double-Clamped ZVS (DC-ZVS)
Isolated, regulated, DC-DC or AC-DC converter



Sine Amplitude Converter (SAC)
Isolated, fixed-ratio, DC-DC transformer

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NBM™ non-isolated bus converter module

- Bidirectional 48/12V
- Input: 40 – 60V
- Output: 10.0 – 15.0V
- Current: Up to 80A
- Efficiency: Up to 97.9%
- As small as 22.8 x 17.3 x 5.2mm

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DCM™ non-isolated regulated DC-DC converter modules

- Input: 40 – 60V
- Output: 10 – 12.5V
- Power: Up to 2kW
- Efficiency: Up to 96.5%
- As small as 36.7 x 17.3 x 5.2mm
- PMBus interface

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DCM™ isolated-regulated DC-DC converters

Input: 9 – 420V
Output: 3.3, 5, 12, 13.8, 15, 24, 28, 36, 48V
Power: Up to 1300W
Efficiency: Up to 96%
As small as 24.8 x 22.8 x 7.2mm
Optimized for array up to 8 units with no power de-rating
OVP, UVP OCP, and short circuit and thermal protection

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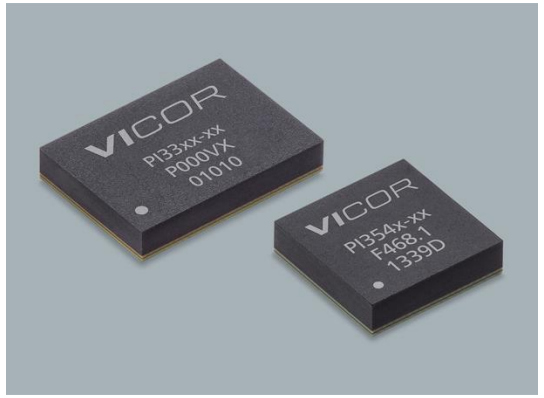
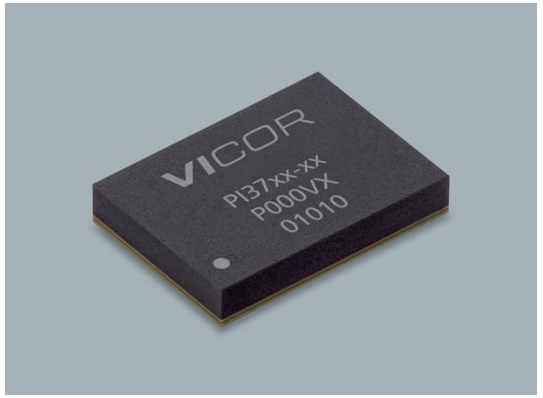
ZVS Buck/Buck Boost regulators



ZVS Buck

- Input: 12, 24 or 48V
- Output: 2.2 – 16V
- Current: Up to 22A
- Efficiency: Up to 98%
- As small as 10 x 10 x 2.56mm



ZVS Buck Boost

- Input: 8 – 60V
- Output: 10 – 54V
- Power: Up to 150W continuously
- Efficiency: Up to 98%
- As small as 10 x 10 x 2.56mm

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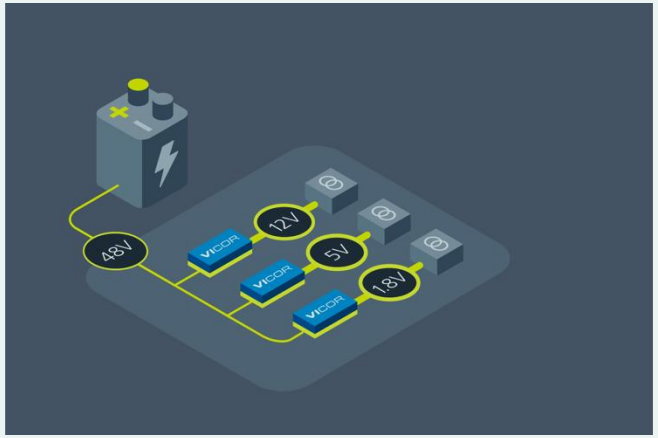
Simpler strategy and implementation



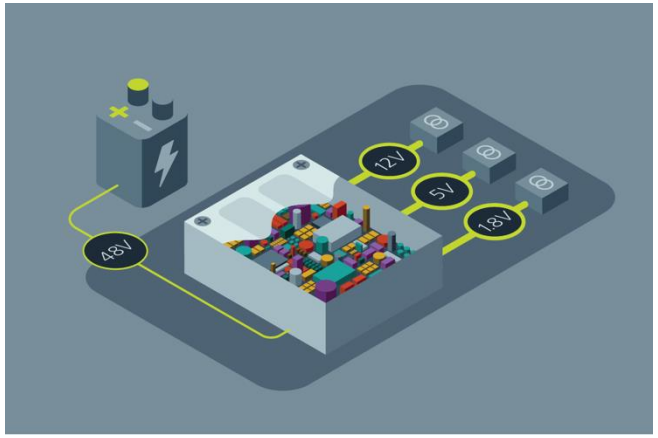
Simple, modular approach

- Up to 5x power density
- Uses less valuable real estate
- Simple thermal management
- Flexible and scalable
- Simple to design and update

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

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Edge computing trends

Booming of artificial intelligence (AI) applications and services

- 80 billion IoT devices and sensors online
- Cloud computing is gradually unable to manage the massively distributed computing power and analyze the data

Edge computing offers data processing at the data source

- Cost, latency, reliability, privacy
- Self-driving cars, intelligent finance, cancer diagnosis, smart cities, intelligent transportation, and medical discovery
- Multi-access edge computing, leverage AI with 5G instrument

Edge computing trends

- Accelerated by the combination of AI and IoT (AIoT)
- Fast processing capability and low latency, high reliability
- Scalability with embedded, compactable

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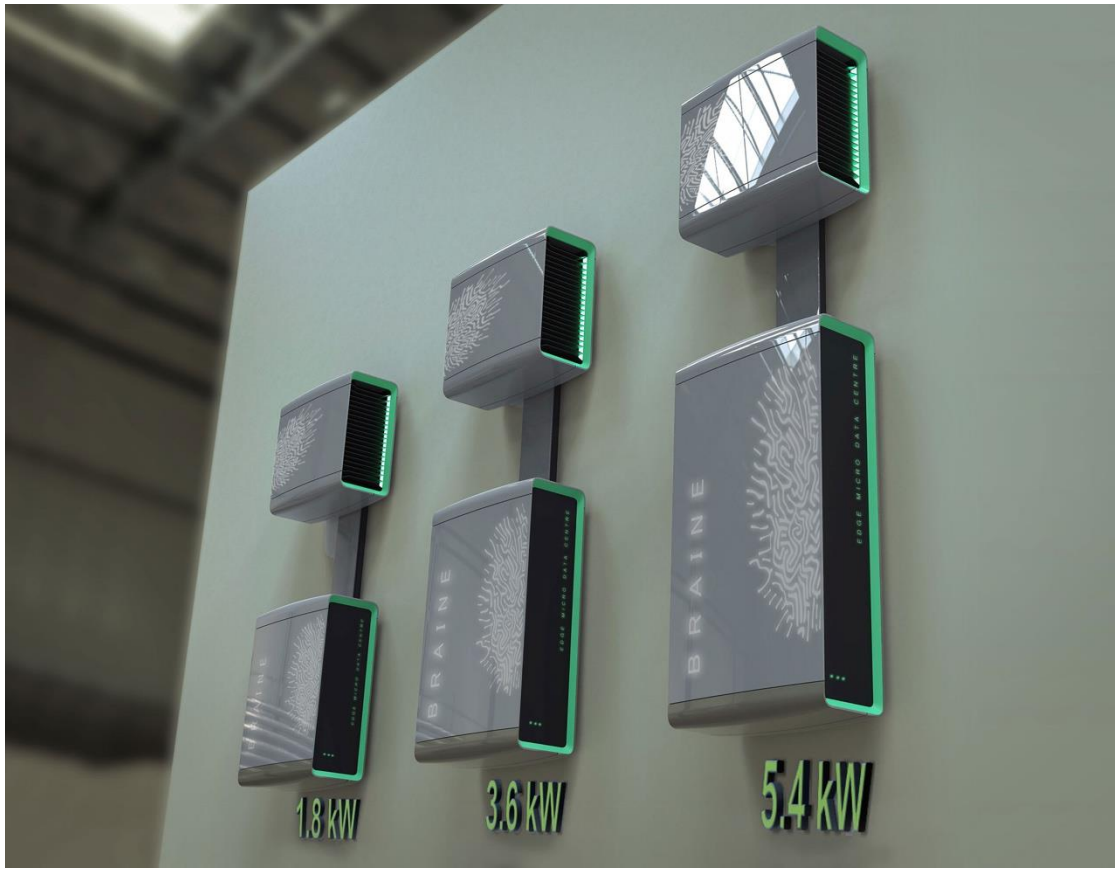
Application: HIRO edge micro data center (EMDC)

- EMDCs are a highly scalable, compact, edge computing resource that can operate reliably in harsh environments and deliver the speed and performance needed for today's applications
- EMDCs can integrate any type and quantity of CPUs, GPUs, FPGAs and NVM media into platforms from 1.5kW shoeboxes to 500kW containerized edge installations



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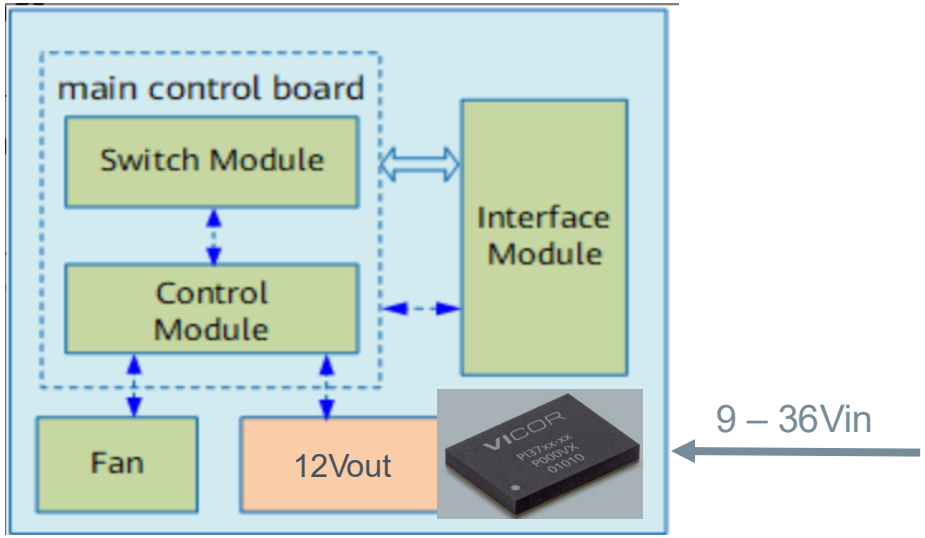
Application: Auto service and router unit (SRU)

- The SRU monitors and maintains switching module and control module
- Processes protocol packets
- Manages the system and monitors the system performance according to instructions of the user and reports the device running status to the user
- Power supplier could well run over 55V due to load dump event



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Summary

- $48V_{DC}$ power distribution, instead of $12V_{DC}$
  - The higher voltage reduces I^2R power losses by 16X across the power delivery network (PDN)
- High-density, high-efficiency DCM power modules contribute EMDC devices against legacy PSU
- ChiP DCM/NBM offer flexible cooling options and world-leading volumetric power density
- PRM/buck boost converter offer wide range input instruments

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Thank you !

Vicor assist for new challenge!