VICOR

Case study: Autonomous electric shuttle

Advanced power module packaging optimizes available power, reliability and safety

Customer's challenge

Low-voltage (48V) autonomous electric shuttles have advanced self-driving systems that navigate complex urban environments. The GPU and sensors are vital components for autonomous operation and rely on high-performance ATX power supplies. These supplies must be compact and lightweight to fit in the vehicle, operate with high efficiency to minimize heat, and maintain exceptional reliability. To keep up with evolving needs, the power system must be scalable to accommodate increasing GPU power requirements and adapt to higher voltage batteries. The main challenges were:

- Avoid overheating and improve thermal management
- Efficiently power GPU to increase functionality and safety
- A versatile and scalable solution to adapt to evolving needs

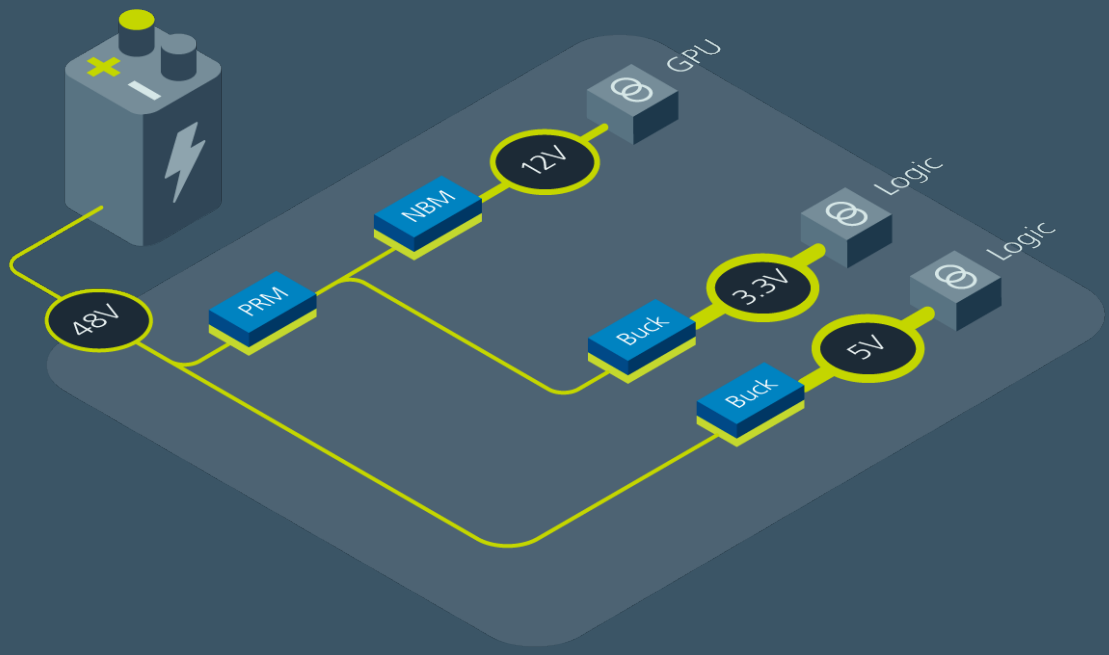
The Vicor solution

Vicor high-efficiency power modules ensure minimal heat dissipation, reducing the need for complex cooling solutions and maximizing power. This translates into higher available power and increased system reliability critical for safety. The high power density of Vicor modules saves space and weight to enable improved vehicle run time and optimize space on board for additional GPU power and functions. Key benefits were:

- Advanced packaging and high efficiency reduce cooling needs
- Easy to scale solution adapts to different vehicles and platforms
- High performance power modules optimize power consumption increasing range and functionality

The Power Delivery Network

A combination of Vicor PRM and NBM modules – Factorized Power Architecture – efficiently steps down a 36-75V input to a stable 12V output. This solution offers scalable performance up to 1,200 watts, ensuring seamless adaptation to the increasing demands of evolving processors. Vicor Zero-Voltage Switching (ZVS) buck converters provide direct, high-current (10A+) conversion from the battery to standard 5V and 3.3V logic rails. This direct conversion minimizes losses and ensures reliable power delivery to critical system components. This power delivery network allows for the vehicle to be retrofitted with a 400V battery by simply adding a bus converter module upstream of the PRM module.



NBM DC-DC converters

Non-isolated fixed-ratio

Input: 36 – 60V

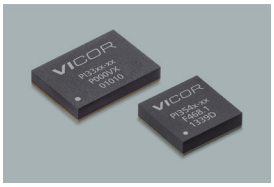
Output: 7.2 – 15.3V

Power: Up to 2400W

Peak efficiency: 98%

As small as 23 x 17 x 5.2mm

vicorpower.com/nbm



ZVS buck regulators

Non-isolated regulated

Input:12V (8 – 18V),
24V (8 – 42V), 48V (30 – 60V)

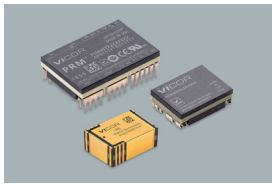
Output: 2.2 – 16V

Current: Up to 22A

Peak efficiency: 98%

As small as
10.0 x 10.0 x 2.56mm

vicorpower.com/buck



PRM buck-boost regulators

Non-isolated regulated

Input: 48V (36 – 75V)

Output: 48V (5 – 55V)

Power: Up to 600W

Peak efficiency: 98%

As small as
22.0 x 16.5 x 6.73mm

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