VICOR

Case study: Logistic robots



High-efficiency power modules maximize system run-time and improve productivity

Customer's challenge

Logistic robots like AMRs and AGVs provide inventory management and order fulfillment tasks within large warehouse environments and can have different sizes and functionalities. These robots are fueled by 24V to 72V batteries with charging performed on an as-needed basis, making power conversion efficiency – along with size and weight – critical. Power conversion is more challenging with navigation, sensing and safety requirements increasing. The key goals were:

- Scalable power so the platform could be quickly reconfigured for different use cases
- High efficiency to extend run time
- Support for a variety of point-of-load voltages without added weight

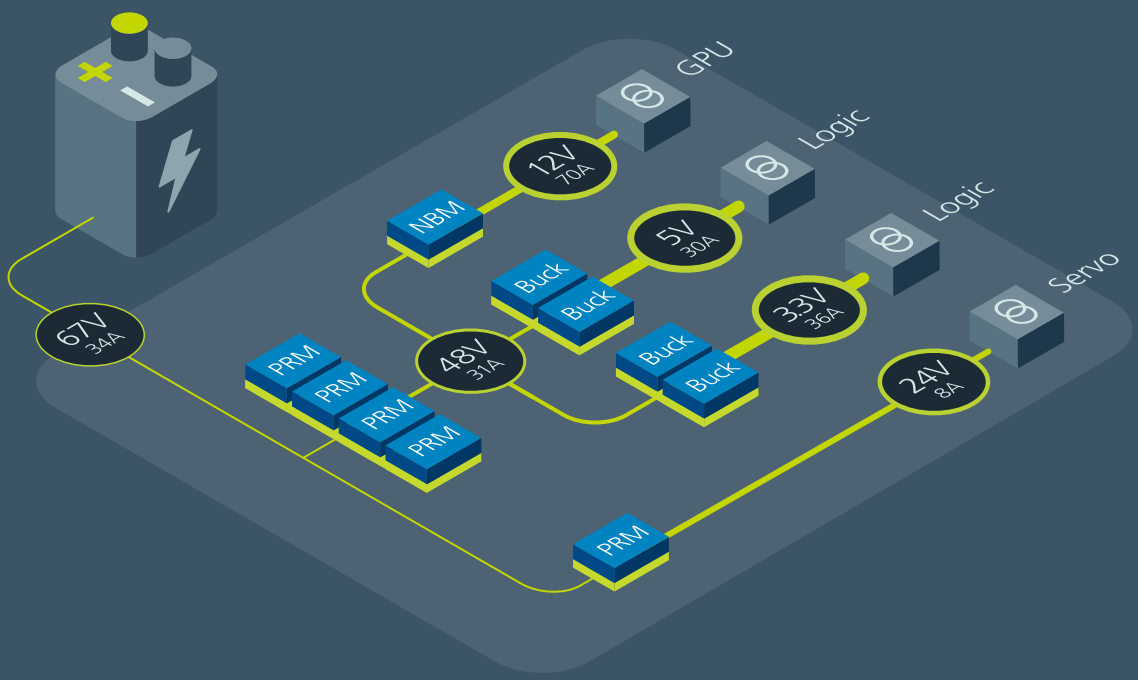
The Vicor solution

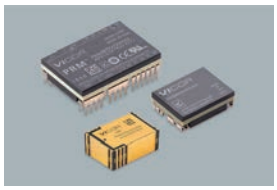
A logistics robots' job is to be productive and move safely through warehouses full of obstacles. Vicor high-performance power modules help save weight and space on board, allowing for more accessories to ensure safe operation. The power delivery network can be easily reconfigured and used for other platforms with different power requirements by simply changing or adding modules. Key benefits were:

- Zero-Voltage Switching topology provides 97.4% efficiency
- Power modules can be scaled to meet diverse power requirements
- Compact, high-density power modules optimize available space

Power delivery network for robots using a 67V battery

The PRM™ power module, a high-performance buck-boost regulator creates an intermediate bus of 24V to 48V with 96 to 98% efficiency to power servos and additional downstream power modules, including fixed ratio NBMs, ZVS buck and ZVS buck-boost regulators. All modules can also be paralleled for higher power conversion.





PRM™ regulator

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

vicorpower.com/prm



NBM™ bus converter

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 regulator

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

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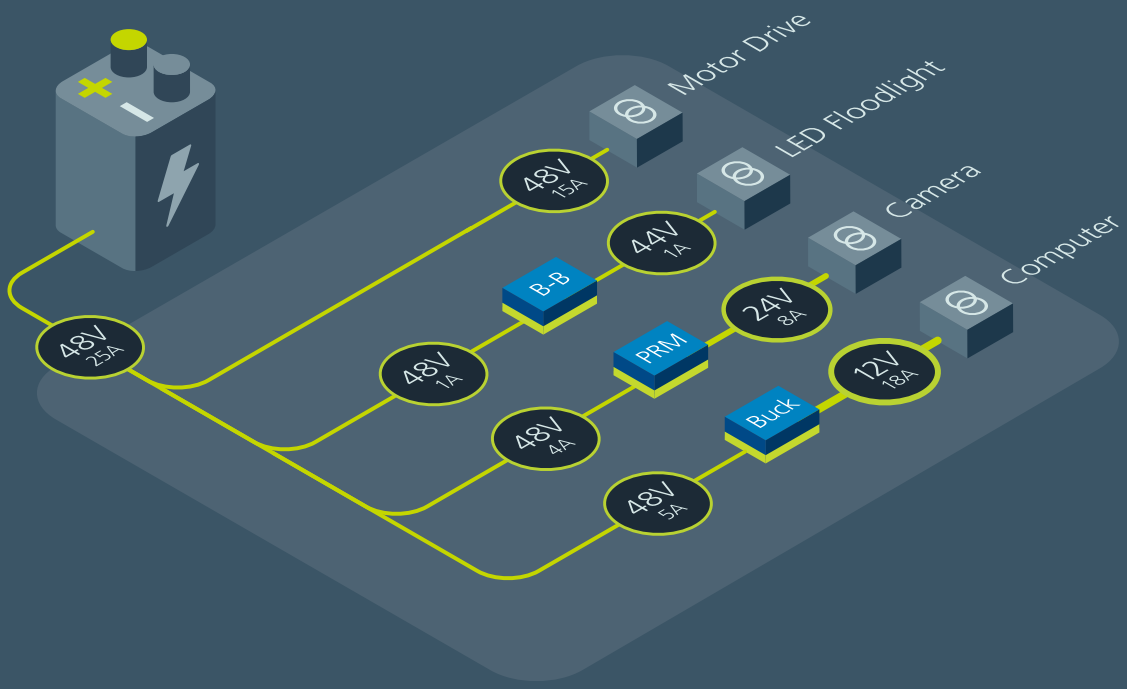
Power delivery network for robots using a 24 to 48V battery

The second powertrain architecture highlights the use of direct conversion from the battery to the point-of-load. PRM, ZVS Buck, and ZVS Buck-Boost regulators support these applications. One example is the PI3740 ZVS Buck-Boost regulator which provides more than 100W of power from a 10 x 14 x 2.5mm SiP package with peak efficiencies of up to 96%.





ZVS buck-boost regulator

Non-isolated regulated

Input: 8 – 60V

Output: 10 – 54V

Power: Up to 150W continuous

Peak efficiency: 97%

10 x 14 x 2.56mm

vicorpower.com/buck-boost



ZVS buck regulator

Non-isolated regulated

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

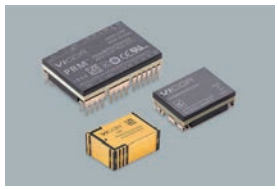
Output: 2.2 – 16V

Current: Up to 22A

Peak efficiency: 98%

As small as
10.0 x 10.0 x 2.56mm

vicorpower.com/buck



PRM™ regulator

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

vicorpower.com/prm

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