

Power Modules Enable 48-V Power Systems For EVs

[Vicor's](#) three automotive-grade power modules for 48-V EV systems deliver industry-leading power density, says the vendor, and will support automotive OEM and tier one production in 2025. The BCM6135, DCM3735 and PRM3735 use AEC-Q100 certified Vicor-designed ICs and have completed the Production Part Approval Process (PPAP) with automotive customers.

"Vicor has set a new standard for power density in the automotive industry with these scalable and flexible miniature power modules," said Patrick Wadden, VP of the Vicor Automotive business unit. "Our high-performance converters enable new possibilities for automotive manufacturers to reduce the size and weight of power systems throughout the vehicle." See Fig. 1.

The Vicor modules can be arranged in over 300 configurations, offering extreme flexibility and scalability to support innovation for a variety of vehicle subsystems. Further, as the market shifts from 12 V to a 48-V zonal architecture, these devices are highly efficient in converting to and from 48 V. All three modules can be arrayed easily to increase power supply levels and have automatic power sharing for optimum performance.

The BCM6135 is a 98% efficient 2.5-kW BCM bus converter and converts 800 V from the traction battery to 48 V to provide a safety extra-low voltage (SELV) power supply for the vehicle. The BCM6135 provides isolation between high voltage and low voltage which creates a large reduction in the space required for dc-dc conversion, according to the vendor.

The BCM6135's power density of 158 kW/L allows EV system designers to shrink the primary dc-dc converter to reduce vehicle weight. The bidirectional rapid current transient response rate of 8 mega-amperes per second allows the BCM6135 to replace a 25-lb 48-V battery by serving as a virtual 48-V battery in xEV vehicles to deliver additional cost and weight savings, according to Vicor (Fig. 2).

The DCM3735 2.0-kW DCM dc-dc converter transforms an unregulated 48-V input into a regulated 12-V output. The DCM3735 has a wide input range that is compatible with a variety of automotive applications because the output can be trimmed within a range of 8 to 16 V. The DCM3735 has a power density of 300 kW/L making it an attractive choice for architectures bridging 48-V distribution to 12-V subsystems in zonal ECU applications.

The PRM3735 is a 2.5-kW PRM regulator for 48-V power that is 99.2% efficient. Its small footprint and 260-kW/L power density frees up packaging space and reduces the volume and weight of the dc-dc power supply. It is best suited for regulated 48-V loads implemented in new vehicle architectures (Fig. 3).

"Our power modules make it easy to convert from the primary battery (800 V or 400 V) to 48 V and down to load," said Wadden. "They are very versatile, and our customers are using the modules to improve efficiency while also removing size and weight from their power systems."

For more information, see the Automotive solutions [page](#) or Automotive power modules [page](#).

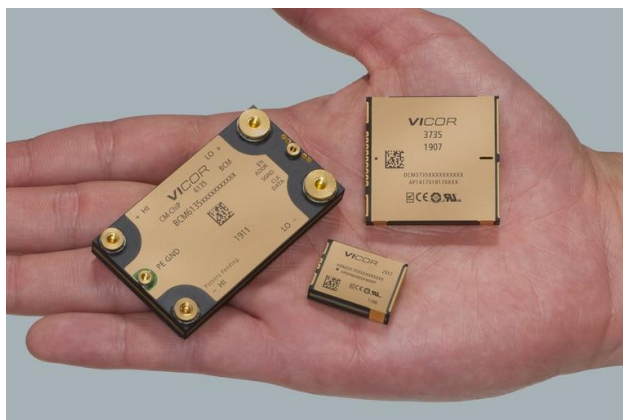


Fig. 1. Vicor's BCM6135 (on the left), DCM3735 (upper right) and PRM3735 (lower right) automotive-grade power modules enable high-power-density dc-dc conversion in applications with 800-V, 400-V, 48-V and 12-V buses.

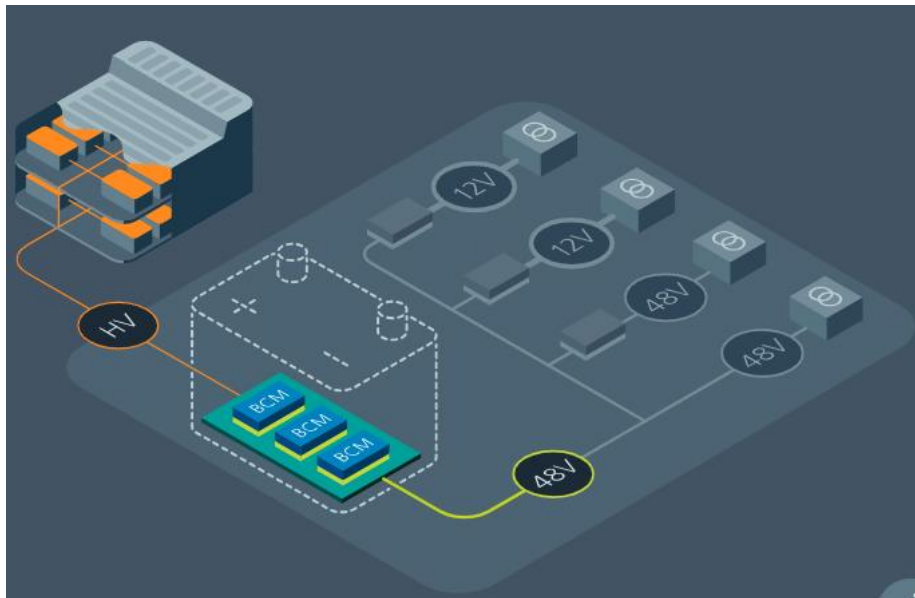


Fig. 2. The BCM6135 power modules enable 800-V and 400-V batteries to supply 48-V power delivery networks, while reducing weight and space consumption. Power level can be increased and decreased by 2.5 kW simply by adding or removing a module. As shown, three BCM6135s provide 7.5 kW of power. Additionally, the BCM6135 provides bidirectional power conversion and fast transient response, eliminating the need for intermediate energy storage at 48 V. Therefore, the BCM6135 can virtualize the HV battery to look like a 48-V battery within the system without the space and weight associated with a physical 48-V battery—something a discrete solution cannot do, according to the vendor.

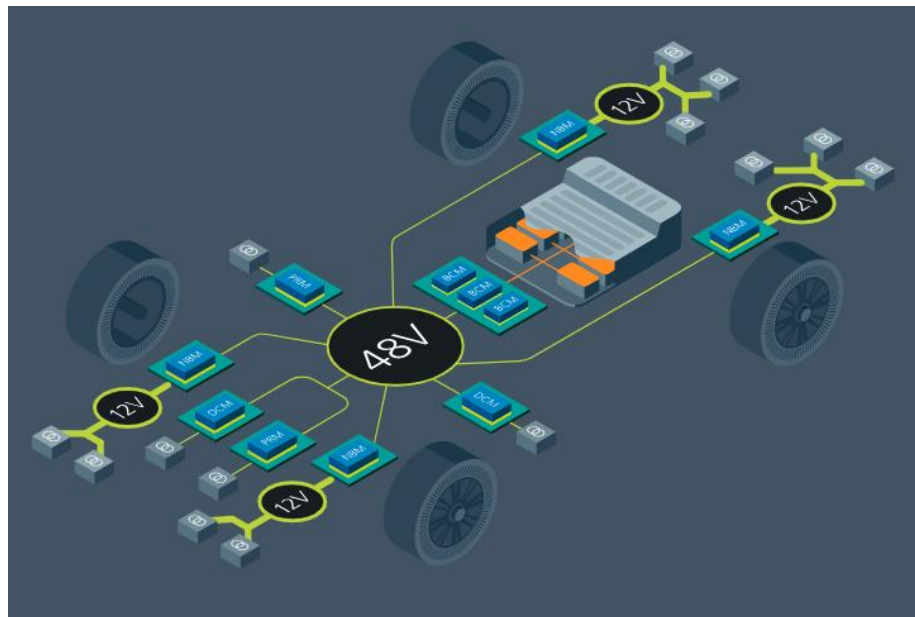


Fig. 3. Providing power to the growing number of loads in a 48-V zonal architecture requires high-density modules, since larger and bulkier discrete solutions add much more bulk and weight. Compact power modules can be located close to the points of load, in tight spaces where alternatives would never fit. The Vicor NBM2317 (previously introduced) provides 48-V to 12-V fixed ratio conversion to power legacy 12-V loads at 98% efficiency. When regulation is required, the Vicor DCM3735 supports 12-V loads and the Vicor PRM3735 supports 48-V loads. With unprecedented density and no need for liquid cooling, these converters can be deployed throughout the vehicle, creating a much more efficient 48-V power delivery network, says Vicor.