Power Modules Boost Innovation

At a recent press conference in Munich, Vicor, "The High Performance Power Module Company", gave an insight on how its keyword "Powering Innovation" is reflected in its customers' developments.

By Roland R. Ackermann, Correspondent Editor, Bodo´s Power Systems

These developments range e.g. from powering air travel with eco-friendly, high-efficiency electric systems (Ampaire) through driving the next generation of robotic autonomy (WiBotic providing wireless charging solutions that support the rapidly growing ecosystem of aerial, mobile, marine and industrial robots), or enabling next-generation brain surgery via edge computing (Hiro Microdatacenters), harnessing ocean waves to power remote marine application (C-Power) to building the world´s safest and most efficient truck driver (Kodiak Robotics).

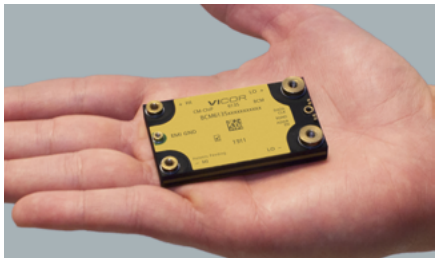
Reimagining and optimizing the future of automotive electrification

Greg Green, Automotive Marketing Director of Vicor, explained, how Vicor helps to speed EV development: As the auto industry enters the next wave of electrification making EVs more affordable has come again to the forefront of design needs. A solution that makes the EV both lighter and more affordable, is to use a 48V zonal architecture (ZA) for all of the non-propulsion loads. Switching from a 12V architecture to a 48V ZA reduces the power wire harness weight up to 85% and cuts costs by up to 90%.

Vicor plays a major role in this transition by providing lightweight, power-dense transformation of the high-voltage (HV) battery power down to a safety extra-low voltage (SELV) level of 48V; the Vicor BCM bus converter produces 2.5kW of 48V power from a compact form factor weighing a mere 58g that has a volume of only 0.016L. Additionally, the BCM6135 can transform power so quickly it serves as a virtual 48V battery, enabling the removal of the auxiliary battery, saving up to 15kg of battery weight.

Vicor also helps OEMs address a major roadblock to adopting the 48V ZA, which is the huge number of 12V points-of-load (PoL) and devices that require redesign or replacement. Vicor NBM non-isolated bus converter product line provides for space- and weight-efficient 48V-to-12V power transformation at the point-of-load. One NBM2317, weighing 12g and only 0.003L in volume will provide up to 1kW / 25A of 12V power, converted at 97.9% efficiency.

This enables the OEM to immediately achieve the major weight and cost savings of a 48V ZA while continuing to use proven, low-cost 12V devices over a longer transition timeframe. In addition to its best-in-class power density and efficiency, the NBM2317 also supports bidirectional power flow. This means surplus energy stored in the vehicle can be used to power other auxiliary functions (V2X) making the vehicle a mobile energy source if required. The Vicor BCM6135 and NBM2317 are just two examples of Vicor products that support vehicle electrification with lightweight and high-power-density DC-DC conversion.



Reducing the Generative AI power impact by billions of dollars

Maury Wood, VP Strategic Marketing, explains, how Vicor is working hard to make genAI training and inference as environmentally responsible as possible, while improving genAI processor performance:

The era-defining global trends of rapid climate change and generative artificial intelligence (genAI) computing are colliding. AI training engines use graphic processing unit (GPUs) to model the artificial neural networks that underpin large model genAI applications. The number of GPUs utilized to train next-generation trillion-parameter artificial neural network models is in the tens of thousands of GPU-based accelerator boards per genAI supercomputer, executing quadrillions of 64-bit floating point operations per second. GPUs require about five times more electrical energy to function than more traditional cloud CPUs, largely due to the massive number of additional transistors in their highly parallel arithmetic logic units. The operation of an AI data center's switching and processing infrastructure (including providing adequate cooling for these machines) is one of the most electrically power-intensive challenges on the planet, particularly given that these data centers run continuously 24/7. Bloomberg has reported that training a single genAI model can use more electricity than 100 U.S. homes use in a whole year.

From the perspective of a power systems engineer, genAI processors convert the electrical power applied to them into thermal power, i.e., hundreds of watts of heat dissipated continuously. At the same time, the dynamic activation of circuit blocks on these advanced processors drives the need for power delivery solutions with a high dynamic range with respect to continuous-to-peak current transitions.

In recent system level evaluations at leading genAI accelerator OEMs, the Vicor Factorized Power Architecture (FPA), with its current multiplier modules placed in a lateral/vertical power delivery (LVPD) configuration, have demonstrated about a 15% reduction in genAI acceleration subsystem power consumption. Vicor estimates that this saving, when scaled to hundreds of AI supercomputers globally, could lead to an annualized 10 basis point (0.1%) reduction in the forecasted global electrical energy consumption in 2026. At $75 per megawatt-hour, this is about $2B of global electricity cost savings and about 11 million tons of equivalent carbon dioxide emissions savings in 2026 alone.

Vicor current multipliers utilize a proprietary Sine Amplitude Converter (SAC) topology to deliver high amounts of current at low voltage with minimal local energy storage through zero-current and zero-voltage switching techniques. Conceptually, current multipliers, in combination with Vicor regulators, behave as ideal current transformers, with scalable gains from 100 amps to over 1,000 amps for sub-1V Volt genAI processor rails. Vicor current multipliers enable real world current density levels three times that of competitive alternatives.

The power saving produced by Vicor FPA and voltage-transforming current multipliers vertically positioned directly beneath genAI processors comes from both reduced PCB power delivery network ohmic losses, as well as reduced voltage gradients across these processor's ball grid array field (measured in square centimeters) – 100mV of supply voltage gradient reduction when delivering 500A is 50W of continuous power savings. Vicor current multipliers offer superb transient performance for modern genAI processors, in thin and scalable packaging with outstanding thermal characteristics, making them ideally suited for highly efficient vertical power delivery networks (VPDNs).

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