Converting High Voltage to SELV
Safely, Efficiently and Economically

Booth 325

Patrick Wadden,
Vice President: Automotive Business Unit
Vicor Corporation

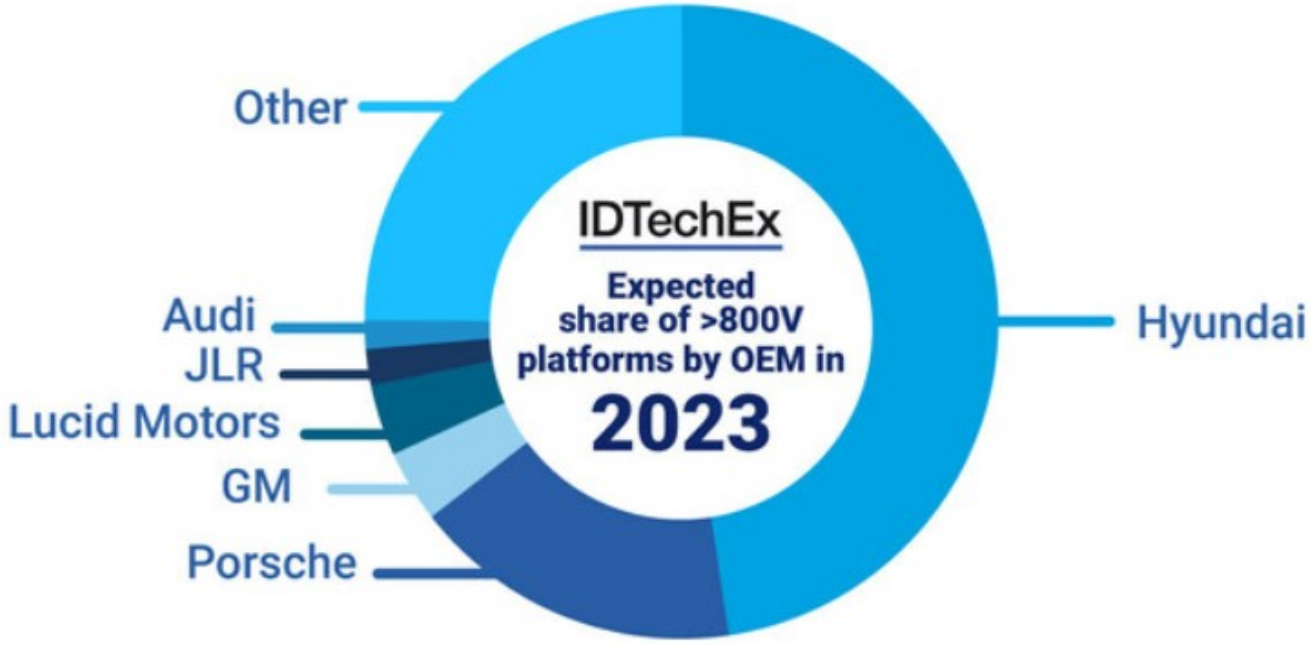
April 16, 2024

Automotive xEV trends

- Tech Insight forecasts xEV production to grow at a CAAGR of 18%, with volumes reaching 57.8 million units by 2030.
- Mechanical costs in a vehicle are coming down and electrical content is going up!
- Semiconductor demand from xEV powertrain systems is forecast to grow at a CAAGR of 24% from $8.3 billion in 2022 to $30.5 billion by 2030
- The 800V battery is the preferred choice for most OEMs
- 48V is the becoming the new 12V

The 800V Battery Vehicle Market in 2023

- Benefits in faster charging, improved efficiency, enabling higher power powertrain systems
- The efficiency argument for 800V is stronger. This allows joule losses to be reduced and high voltage cabling to be downsized.
- The market today is heavily dominated by 800V battery systems



Source : PR Newswire

Most OEMs are moving to 48V

48-Volt Mild Hybrid Systems: BMW

Posted on 16 November 2023 | Share: | Print

Mild hybrid systems are not new. They were some of the first hybrid vehicles to be put into production. The 48-volt mild hybrid system is now becoming more common among some vehicle makers. What considerations are there for repairing a vehicle equipped with a 48-volt mild hybrid system? Let's see what BMW has to say.

BMW first introduced the 48-volt mild hybrid system in July 2020 stated in **ST-2007 48-Volt Electrical System** a technical training manual from BMW. This system reduces emissions, improves the automatic engine stop/start, engine off coasting and aids the combustion motor with an eBoost function.

Per BMW:

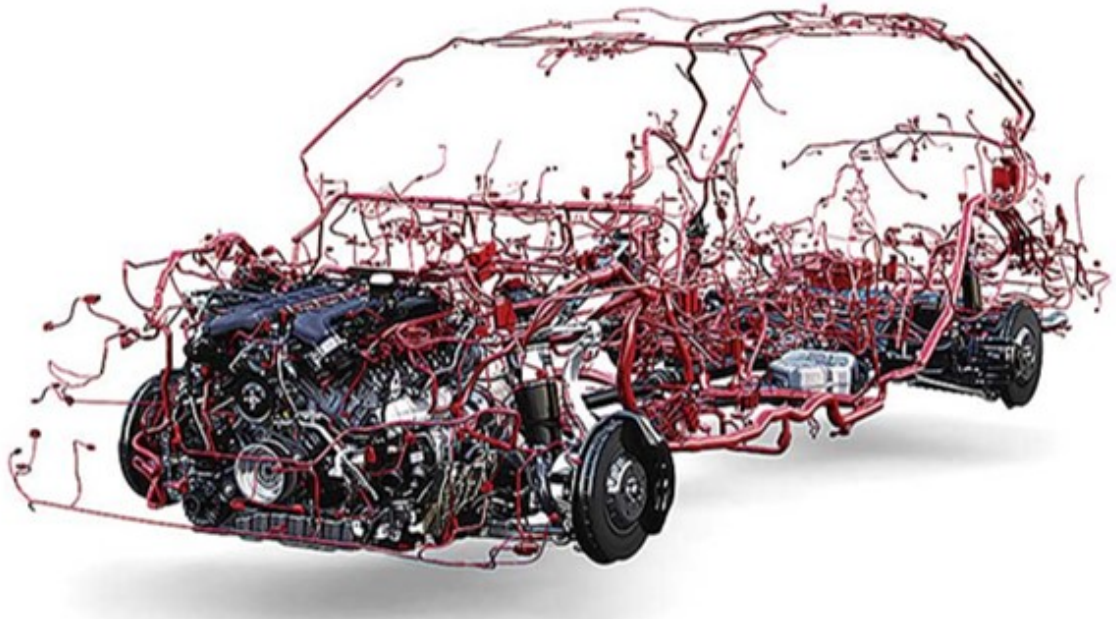
- "The 48-volt system will be included on all future vehicl
  engine."
- "48-volt warning labels and cables are now purple in co
  the 48-volt system."

SECOND GENERATION FORD EVS MAY GET 48V ARCHITECTURE

By Edward Snitkoff
December 7, 2023 3:31 pm

Why the automotive industry is finally moving to 48V

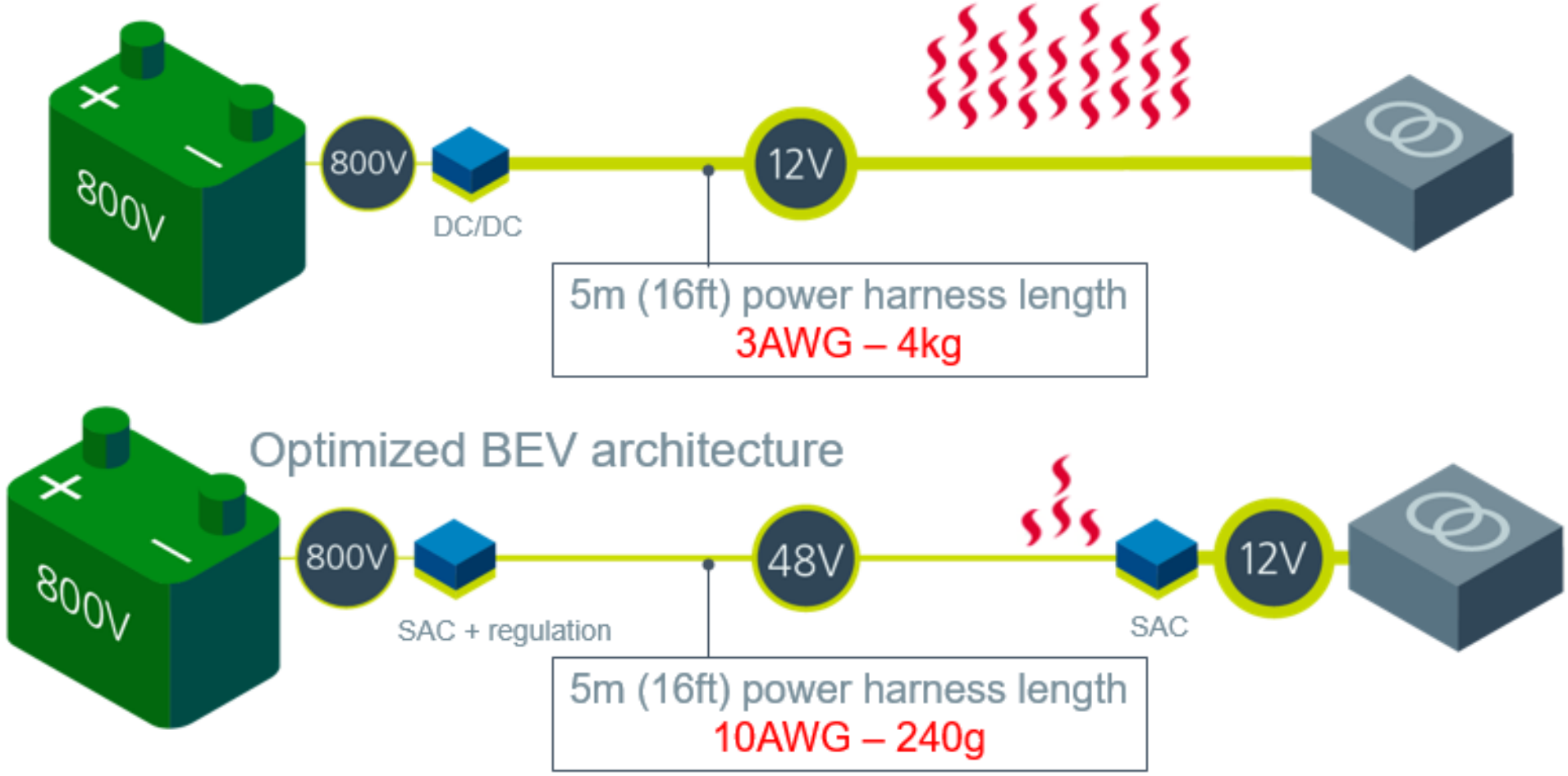
- Higher voltage systems result in lower current for equal power, reducing cabling and cooling
- Higher increasing power loads like active suspension are more practical on 48V needing higher power
- 48V zonal architectures being implemented to reduce weight and losses



The wire harness is one of the three heaviest subsystems in today's vehicles

- 2,000 copper wires totaling 1 mile in length
- 150lbs in highly contented vehicles

Enabling up to 85% wire harness weight reduction & 60% cost reduction on a BEV architecture

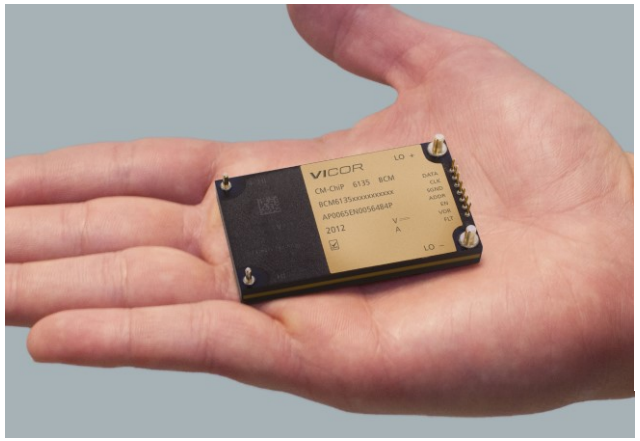


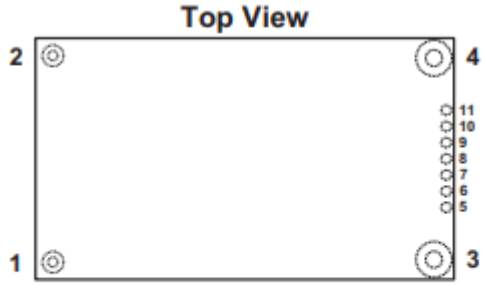
Challenges converting high voltage 800V to SELV

- Very complex design with significant voltage drop
- Highest efficiency needed to minimize energy losses and ensure safe operation
- Challenges with heat and cooling
- Tend to be large systems, heavy in weight and size
- Limited ability to scale
- Achieving fast transient response with discrete designs- ability to adapt to rapid changes in load while maintaining stability

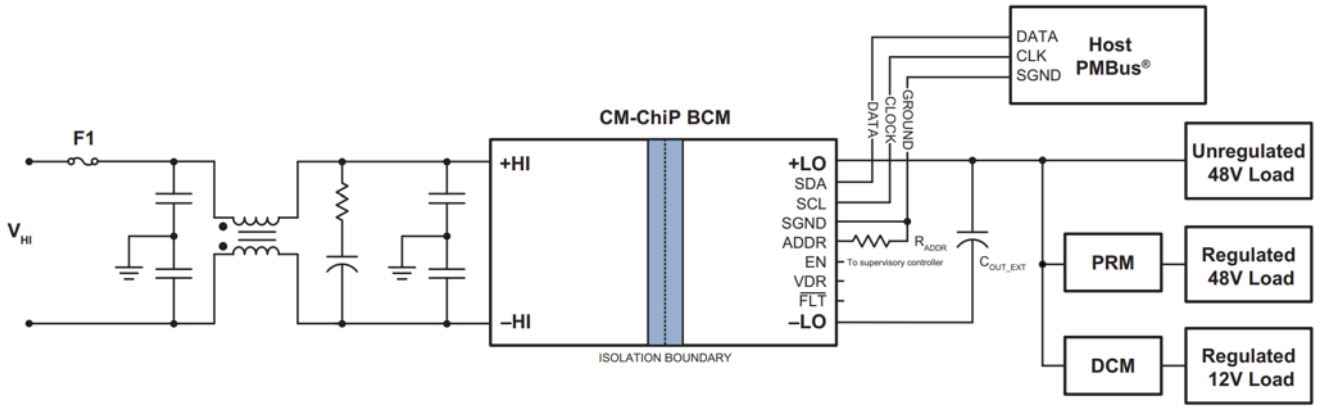
The “BCM” Bus Converter Module

- Single converter housed in package
- Efficiency at 97%
- Transformation K = 1/16
- Scalable, flexible, parallel
- Wide Vin range 320V-920V
- Output Power 3.5KW
- Quiescent current <1mA
- Output current 80A continuous
- Bi-directional start-up and steady state
- Eliminate the need for an energy storage device, reduce component count
- Easy to implement compared to a traditional DC/DC converter





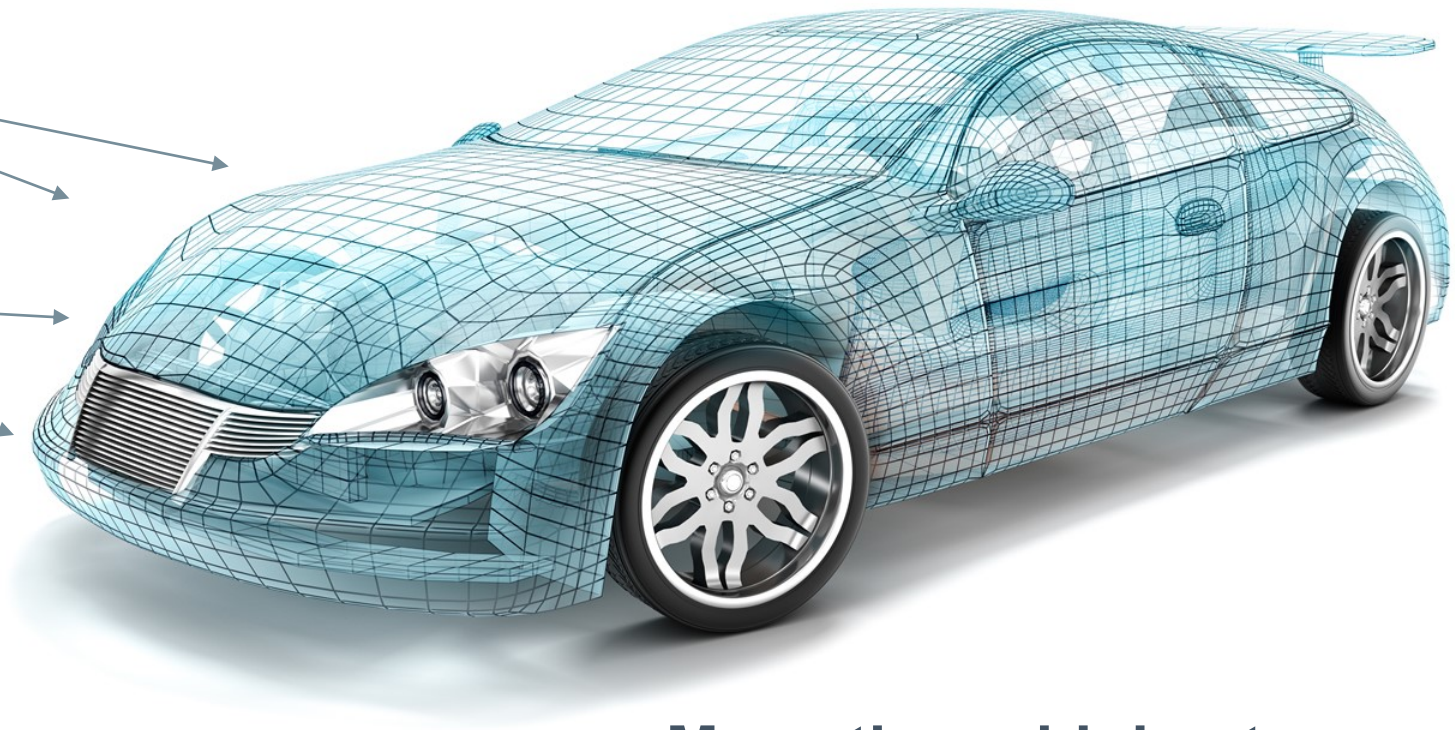
BCM6135 in a CM-ChiP Package Through-Hole Mount



Today's vehicle power hungry loads, ideal for 48V, ideal for modular

- Heated windscreen
- **Active suspension and stabilization**

- Pumps & fans
- Blower motor
- High end audio
- Actuators
- Steering
- Braking



Move those highest power loads to 48V first, 300W and up

800V-48V DCDC

HONGFA

1. Charateristics

Product	800V-48V DC/DC
Input Voltage	800V: 600V ~ 900V(DC)
Output Voltage	48V: 37.5V ~ 56V(DC)
Sustained power	5KW @25℃
Peak efficiency:	95.3%
Sustained current	48V/105A@25℃
Communication interface	CAN
IP Level	IP67
Out Dimenson L×W×H:	312*216 *87mm

2. Features

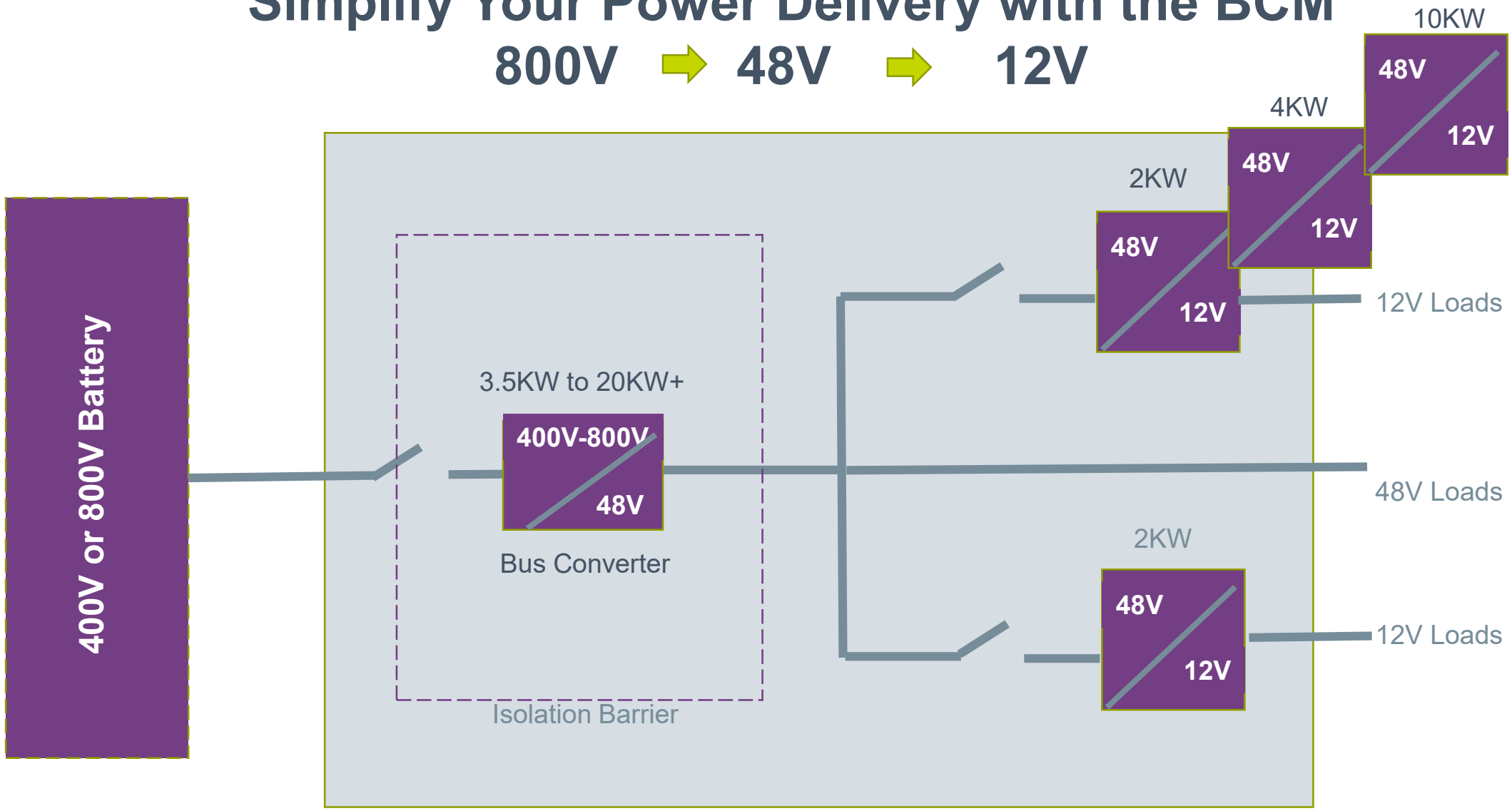
- Small Size
- 1/16 Linear transformation

3. Application

- 48V Electric architecture of new energy vehicles

Simplify Your Power Delivery with the BCM

800V ➡ 48V ➡ 12V

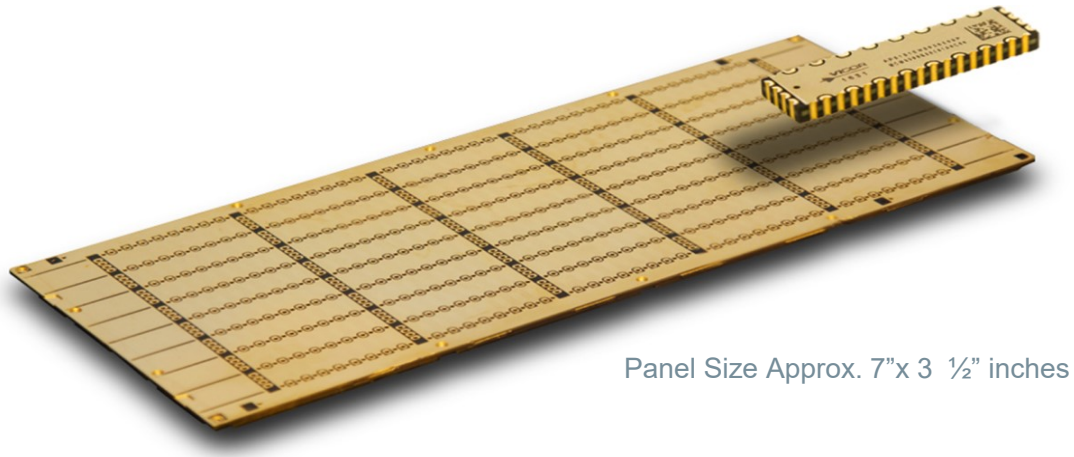


Every Module can be easily paralleled or scaled to any power level

Our modules are 100% Made in the USA

- **C**onverter **H**oused **i**n **P**ackage
- The first CHIP factory in the world
- Manufactured in Andover, MA
- Over 300,000 sq ft of manufacturing space

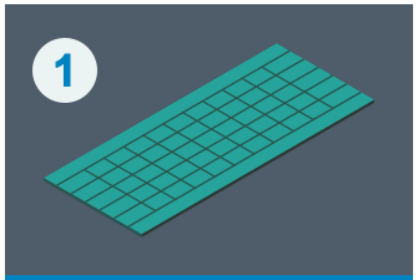
Vicor's Unique Packaging and Manufacturing Approach to Low Cost, High Performance Power Supplies for the Automotive Industry….



Panel Size Approx. 7"x 3 ½" inches

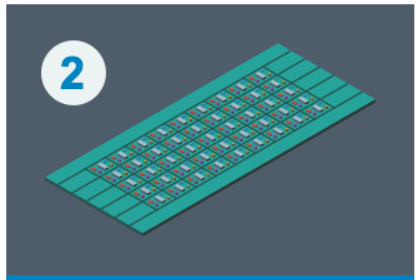
- Surface mount, 3D packaging, low cost, scalable
- Produced on Vicor highly automated SMT manufacturing lines
- Fabricated in panel (wafer) form
- Enables module design flexibility and
- Highly flexible and scalable for voltage levels, output power rating and package size WITHOUT MANUAL re-tooling
- Streamlines manufacturing process for various technologies: Isolation, regulation and transformation

World’s first Chip Fab (converter housed in package)



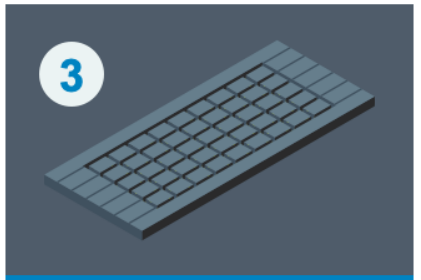
Bare panel

The process begins with a bare panel, ready for multiple instances of the same high-performance module, analogous to a silicon wafer



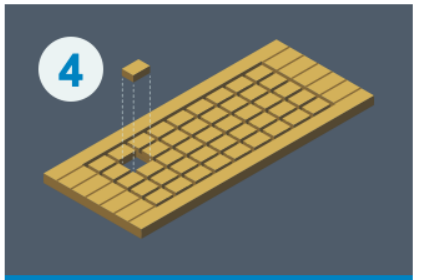
Surface mounting

High-quality power components, including magnetics, are mounted and soldered via state-of-the-art pick-and-place tools



Overmolding

A plastic compound encases the panel, protecting the components and creating a flat surface that makes the final product easier to handle



Plating

Heat conducting metals are plated onto the panel to enable a thermally efficient and reliable finished product

CHiP modules

The panels are singulated into individual modules and tested for conformance to data sheet specifications

Vicor Snapshot

- (NASDAQ: VICR) Andover, Massachusetts, Public company
- Vicor has approximately 10,000 customers, and just over 1,100 employees worldwide
- Over $1B+ invested in proprietary architectures, topologies, control systems and packaging
- **Organized into four business units:** Automotive, Industrial, High Performance Computing and Aero/ Defense
- Debt free
- Exclusively focused on power

Thank you

Booth #325

