Powering robots that harvest, deliver and move

The most efficient power delivery for robots

VICOR

The need for more power

Almost everything around us is touched at some point by robots. There are robotic applications utilized in agricultural harvesting, warehouse inventory movement, campus delivery and consumer delivery. These robots are fueled by batteries, making power conversion efficiency – along with size/weight – critical. Power conversion needs become more and more challenging as load capacity, visual recognition and user functionality requirements further increase within the robotic application.

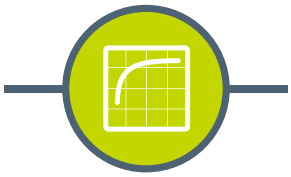
Delivering high power with efficiency and reduced weight

Vicor power modules support a component-based power delivery network to power motor drives and demanding CPUs. Each power module is optimized for high-efficiency, density and overall performance. Vicor modules are also lightweight compared to competitive solutions, enabling further performance gains for battery-powered robotic devices. Power modules can also be paralleled, allowing for designs to easily scale in power as robotic power demands increase and also allow for the same power architecture to be deployed within a platform of various sized robot systems.

Benefits of Vicor modules

High density

Modular and scalable



Efficiency up to 98%

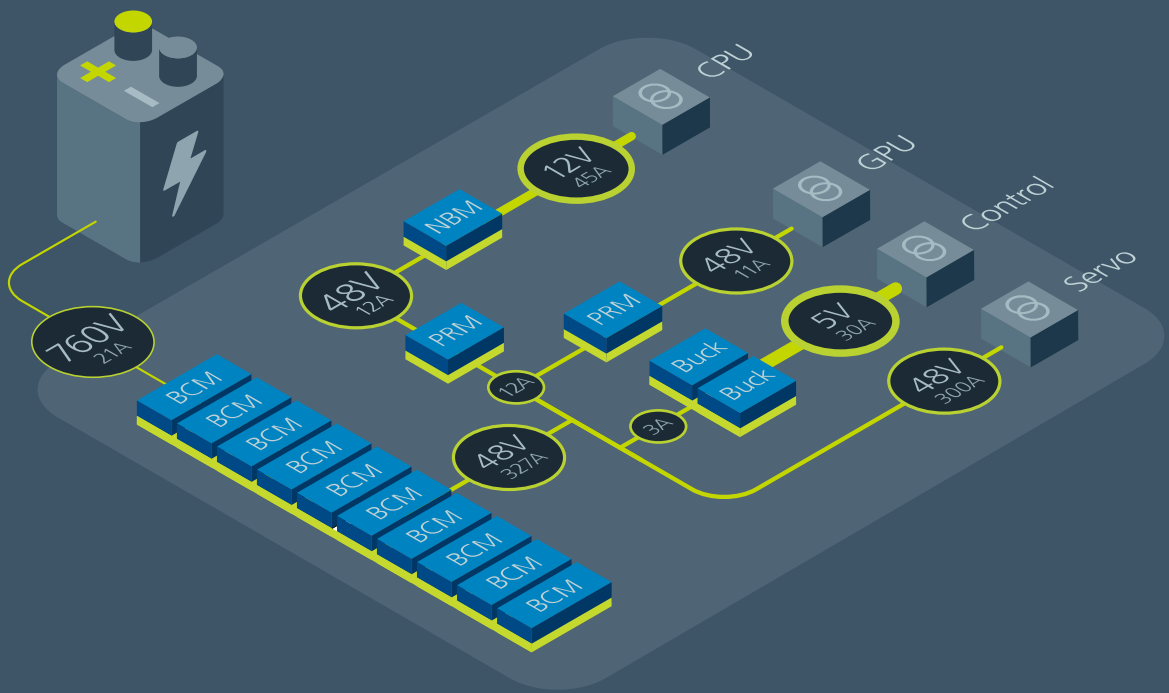
Lightweight

Harvesting robot

Various produce including strawberries, apples and lettuce are being planted, maintained and harvested using automated vehicle guidance along with visual recognition robotics. Large robotic vehicles or equipment are typically powered from a high-voltage DC source of 400V or more.

Power delivery network

The Vicor BCM converter series can provide high-voltage battery conversion to a safe, nominal 48V. One example is the BCM4414 capable of more than 1,600W at greater than 97% efficiency from its 111 x 36 x 9mm package. The BCM is a fixed ratio converter with an output voltage 1/16 of the input voltage. Fixed ratio or regulated point-of-load converters such as Vicor NBMs, PRMs, ZVS Buck and ZVS Buck-Boost regulators power individual, downstream, lower-voltage rails as needed.

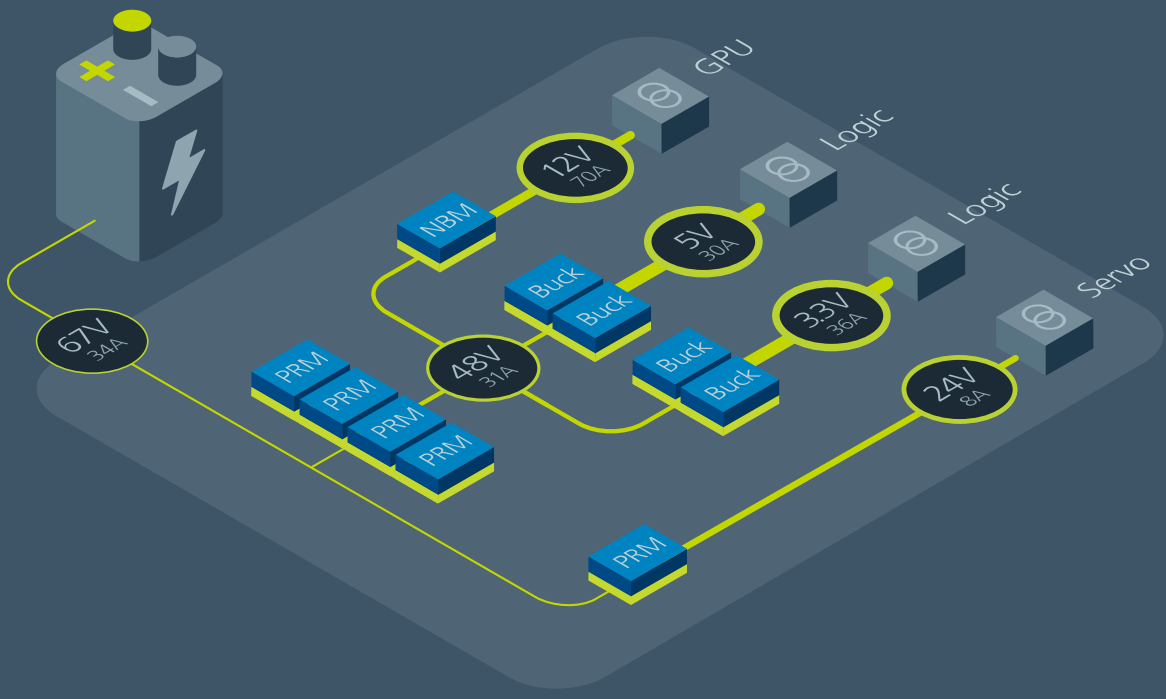


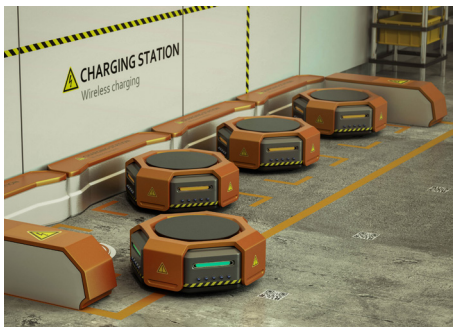
Moving robot

These nimble robots provide inventory management and order fulfillment tasks within large warehouse environments. This class is typically powered from a 24V to 72V battery source with charging performed on an as-needed basis. With high efficiency and small footprints, Vicor power modules support conversion from up to 75V to usable voltages within the robot to efficiently power all of the mobility, guidance, computing, radio and lighting functions.

Power delivery network for robots using a 67V battery

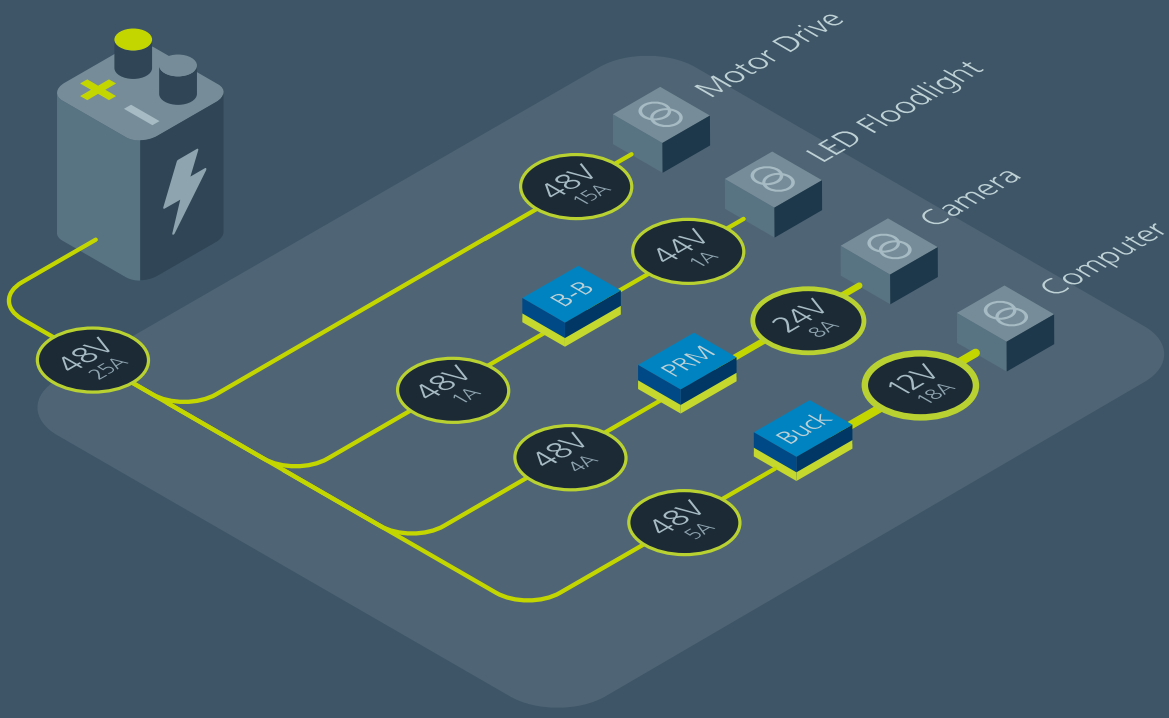
This architecture highlights the PRM power module, a high-performance buck-boost regulator. The PRM creates an intermediate bus of 24V to 48V with 96 to 98% efficiency to power servos and additional downstream power modules, including fixed ratio NBMs, ZVS Buck and ZVS Buck-Boost regulators. All modules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





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

This 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%.

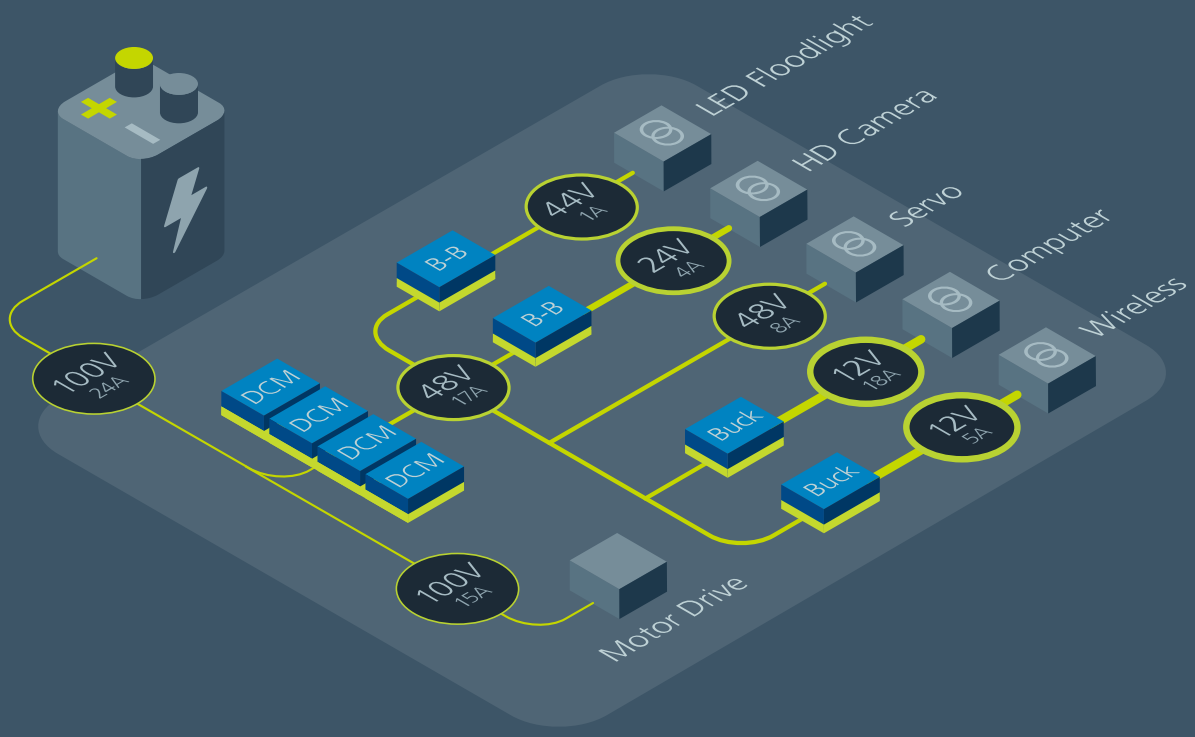


Delivery robot

Last-mile consumer delivery of groceries, take-out food and online consumer items is the mission-critical task of these robots. While payloads vary in size and weight, these robots typically have longer run times than the moving class of robots and are typically powered by 48V to 100V batteries.

Power delivery network

The DCM converter series fits the needs for this class with operation from 43 – 154V input. The DCM3623 enables a regulated 24V or 48V distribution from the battery for servo drives, other payloads and downstream converters. The DCM3623 provides 240W of power at 90% efficiency from a 38.7 x 22.8 x 7.2mm package. With a 24 – 48V rail established, ZVS Buck or Buck-Boost regulators can typically be used to power lower voltage rails.



Products used in robotics power delivery networks

BCM4414 fixed ratio DC-DC converter

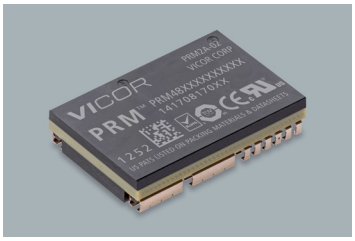
Input: 500 – 800V

Output: 31.3 – 50.0V

Current: Up to 35A

110.6 x 35.5 x 9.4mm

vicorpower.com/bcm



PRM high-power Buck-Boost regulator

Input: 36 – 75V

Output: 20 – 55V

Power: Up to 600W

32.5 x 22.0 x 6.73mm

vicorpower.com/prm

NBM2317 fixed ratio DC-DC converter

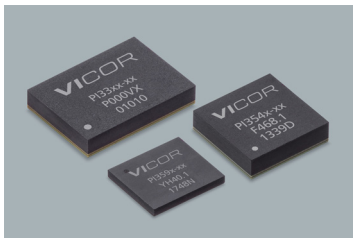
Input: 38 – 60V

Output: 9.5 – 15V

Current: 60A

22.8 x 17.3 x 7.4mm

vicorpower.com/nbm



ZVS Buck regulator

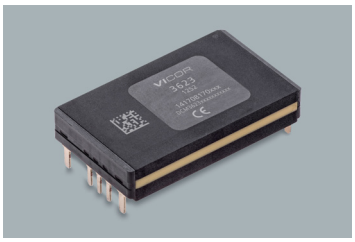
Input: 12, 24, 48V

Output: 1 – 16V

Current: Up to 22A

As small as 7.0 x 8.0 x 0.85mm

vicorpower.com/buck



DCM3623 DC-DC converter

Input: 9 – 154V

Output: 3.3 – 53V

Power: Up to 320W

38.72 x 22.8 x 7.21mm

vicorpower.com/dcm

PI3740 ZVS Buck-Boost regulator

Input: 8 – 60V

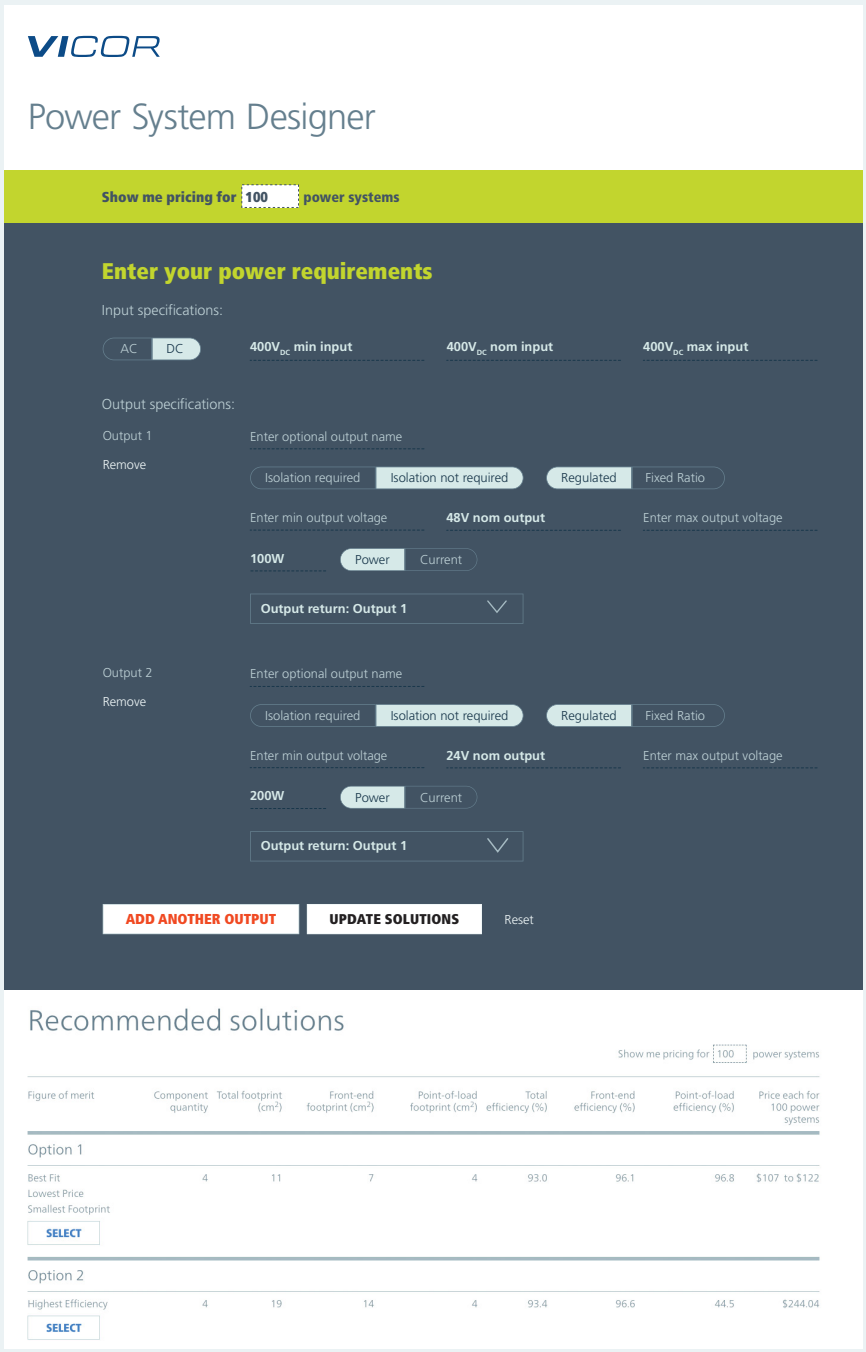
Output: 10 – 50V

Power: 141W

14.0 x 10.0 x 2.5mm

vicorpower.com/buck-boost

An easy solution for generating complete power systems



Just enter a few specs to design your next power system

Designing your power system in a single location — up to 75% faster than traditional methods — is as easy as entering your input and output power as well as your basic system requirements. The Power System Designer is one of the Vicor web-based tools that makes it easy for you to build flexible, efficient and cost-effective power systems that get you to market faster.

- Instant performance analysis for recommended solutions
- Access an infinite number of products and technical specs
- Evaluate power chains electrically and mechanically
- Prioritize solutions by efficiency, component count, cost, footprint and recommended best fit
- Save, export and share a final BOM or power system

Start your next design at **vicorpower.com/psd**

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