VICOR

Case study: Fuel-cell eVTOL



A lightweight solution providing kilowatts of power for auxiliary systems

Customer's challenge

eVTOLs can be used for a variety of purposes, such as urban air mobility, cargo delivery, and emergency response. They are electric vehicles by nature, but they don't necessarily use traditional batteries: they can also use fuel cells to power the aircraft. This reduces overall weight and allows for longer flight times. However, propulsion fuel cell stacks require a substantial auxiliary power system for pumps, fans, cooling fans, and other controls that require kilowatts of power without adding bulk. The main challenges were:

- Test and implement power solutions quickly and easily to gain competitive time to market
- Manage kilowatts of power without adding much space and weight
- Ensure the highest reliability under extreme operating conditions

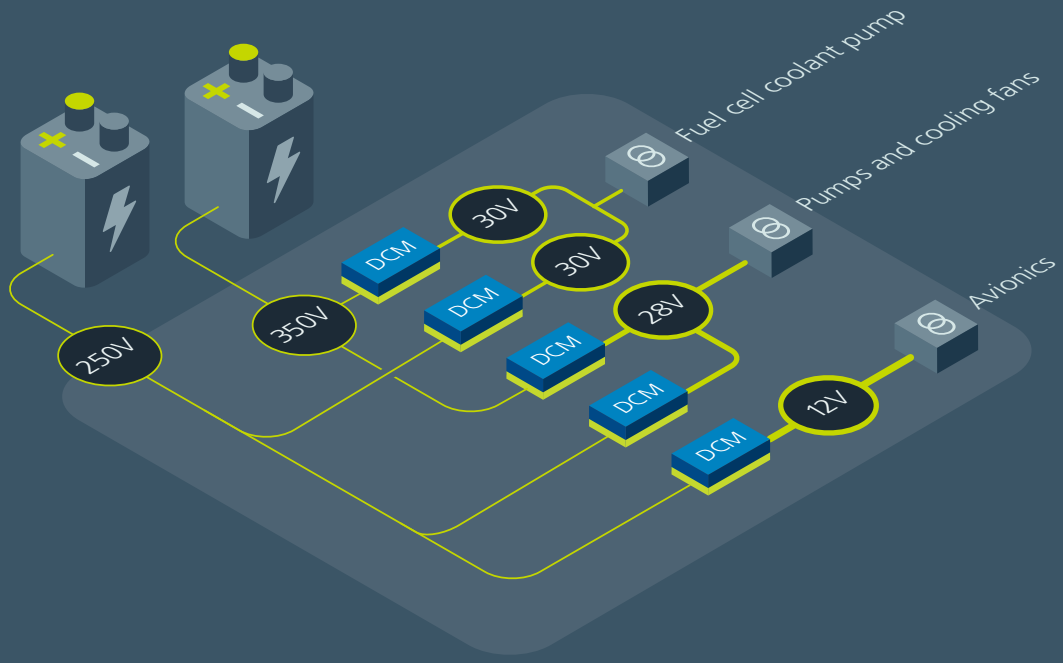
The Vicor solution

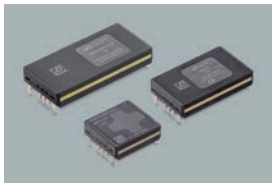
Vicor high-density power modules effectively manage kilowatts of power within limited space. Their light weight reduces energy needed for flight and optimize battery usage, providing the manufacturer more flexibility when designing aircraft. Power modules allow for quick testing and implementation and easily adapt to changing power requirements, accelerating time to market. The key benefits are:

- One design using power modules can meet diverse requirements, or be scaled to meet high power requirements, resulting in less design effort
- Compact power modules optimizes space and weight on the vehicle
- Rugged and highly integrated power modules for high reliability

The Power Delivery Network

Uninterrupted operation of critical auxiliary systems is ensured by leveraging a redundant battery system feeding a 40kW auxiliary power supply. The power delivery network utilizes arrays of Vicor DCM™ DC-DC converters connected in parallel, delivering over 10kW of power. Two sets of DCMs with 30V outputs are connected in series for higher power 60V pumps, utilizing the same part number product for most of the 40kw of auxiliary power, be it 24V, 28V or 60V. With up to 97% efficiency, DCMs reduce heat generation significantly, leading to improved thermal management and reliability. They maintain perfect output current sharing, even when connected to different input voltages, ensuring balanced load distribution and optimal performance. An additional Vicor DCM powers the sensitive avionics systems, providing a stable and regulated power source.





DCM™ DC-DC converter

Isolated regulated
Input: 9 – 420V
Output: 3.3, 5, 12, 13.8, 15, 24, 28, 36, 48V
Power: Up to 1300W
Peak efficiency: 96%
As small as 24.8 x 22.8 x 7.21mm

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