VICOR

EO/IR Case study: Airborne infrared countermeasures

Power averaging improves optical dazzling lasers within existing space constraints

Customer's challenge

Optical dazzling lasers emit intense, non-lethal pulses of light energy, a complex power operation. The system's demand for energy fluctuates with each pulse, requiring averaging out these high-energy bursts. This is essential to maintain a stable current draw on the aircraft's power source and to reduce EMI. Upgrading systems with higher laser power or higher pulse frequencies further complicates these demands since power must be reliable and a solution fit within the same limited space. The key challenges were:

- Ensure a consistent power source current
- Add more power and functionality in the same available space
- Guarantee reliable operation without interfering with the sensitive electronics on board

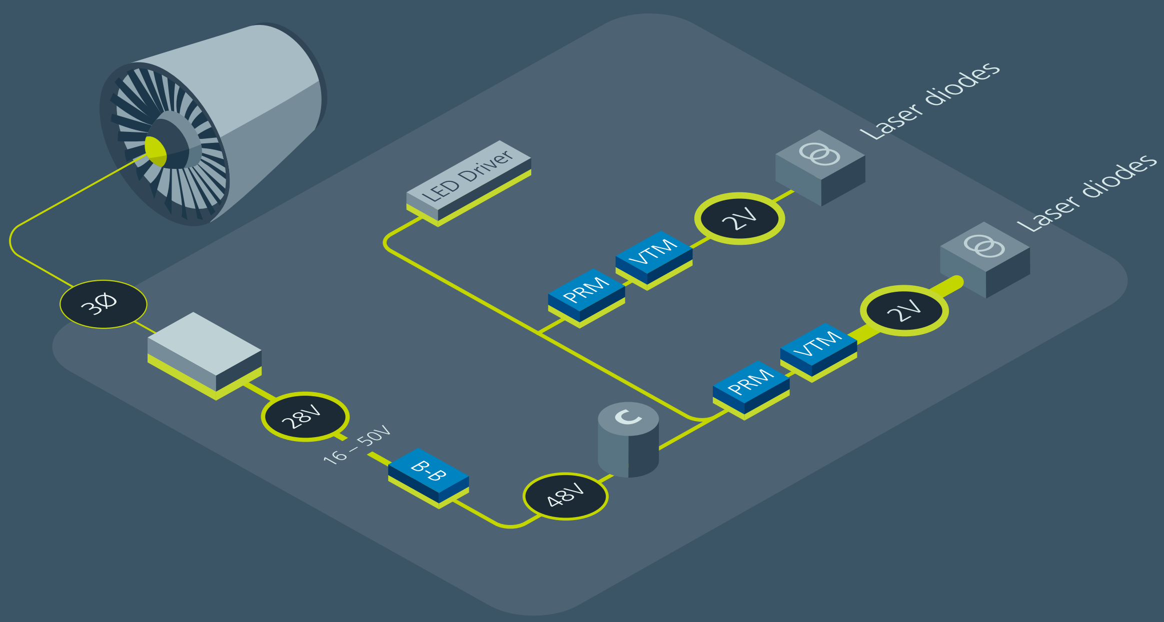
The Vicor solution

Vicor PRM/VTM (Factorized Power Architecture) power modules deliver significant power within limited aircraft space and efficiently dissipate the heat generated during high-power pulsed operation. The Sine Amplitude Conversion (SAC) topology ensures a rapid transient response, which is crucial for effectively driving the laser system with high-current pulses. This combination of fast response and high current delivery directly enhances performance and effectiveness in disrupting threats. The key benefits were:

- FPA enables higher power density compared to traditional architectures
- Fast transient response improves laser effectiveness
- High efficiency reduces waste heat and improves reliability

The power delivery network

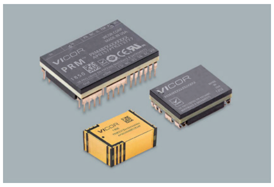
A large capacitor bank provides energy storage for the pulsed loads. Storing the energy in the capacitors at 48V (rather than at the input voltage of 28V) allows the use of smaller capacitors but necessitates input voltage boost conversion from a MIL-STD-704 bus, achieved by using a ZVS Buck-Boost regulator. Pairs of PRM regulators and associated VTM current multipliers provide regulated, high current outputs at 2V to drive the lasers. Configuring these PRMs in remote sense mode allows for the limitation of the magnitude of the output current pulses.



ZVS buck-boost regulators

- Non-isolated regulated
- Input: 8 – 60V
- Output: 10 – 54V
- Power: Up to 150W continuous
- Peak efficiency: 98%
- 10.5 x 14.5 x 3.05mm

vicorpower.com/buck-boost



PRM buck-boost regulators

- Non-isolated regulated
- Input: 48V (36 – 75V)
- Output: 48V (5 – 55V)
- Power: Up to 600W
- Peak efficiency: 98%
- As small as 22.0 x 16.5 x 6.73mm

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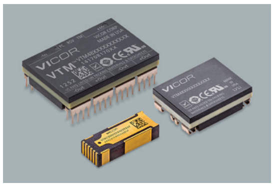

VTM current multipliers

- Isolated fixed-ratio
- Input: 0 – 60V
- Output: 0 – 55V
- Current: Up to 115A
- Peak efficiency: 97%
- As small as 22.83 x 8.52 x 4.9mm

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