48V 48V Architectures | High Efficiency | PCDM | Conduction Cooling

Optical Sorting Machine

Scalable Solution to Reduce Design Complexity and Costs

The Customer's Challenge

Accuracy, consistency and speed of throughput was what one manufacturer of optical sorting machines was seeking to significantly improve in their latest range of equipment. This required additional processing power and the complete redesign of the power supply to support it.

To reduce design complexity and costs, the company was looking at how they could develop one scalable power design to be used across all the machines in the range. Previously they had one high power design for all, which was proving uneconomic for the smaller machines.

To differentiate their products as the most cost-effective and time-saving technology the new machines needed to be reliable, reducing expensive downtime, and energy efficient to reduce running costs.

The Solution

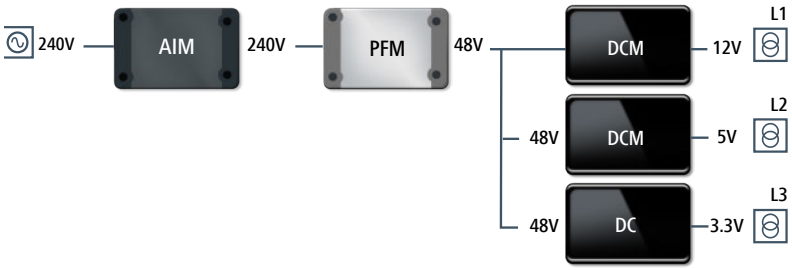
Working with our applications engineers, the design team decided to re-architect their system to incorporate a 48V bus (from their previous 12V), significantly reducing distribution losses, particularly significant for the larger 3.5kW machines.

Vicor's Power Component Design Methodology is a scalable and modular building block approach to power system designs, with each power component optimized to work together to deliver outstanding performance.

A standard card was developed to provide 400W of power. Each card comprised a PFM isolated AC-DC converter to provide the 48V bus to the processor boards. Each processor board is powered by DCM DC-DC converters to provide the high current 5V and 12V processor voltages. PI31xx isolated DC-DC converters provide the low current 3.3V rail. Multiple cards could be fitted to the larger machines, to meet the higher power requirements.

This approach enabled the scalable power solution being sought to match the specific power level of each of the machines in their range, reducing the size and cost of the power being used for the smaller machines.

Link to Whiteboard »



The Results

The scalable, low-loss power solution enabled the company to exceed their initial design objectives. Their sorters were cost competitive and energy efficient. In addition, high performance, high density onboard converters enabled the power solution to fit into a smaller space than originally envisioned. Improved efficiency of the power solution, and the use of conduction-cooled AC-DC converters, significantly improved equipment reliability through better heat management, including the removal of unreliable and bulky fans.

Product Family Key Specifications	
PFM™ Isolated AC-DC Converters with PFC	
Input Voltages	Universal rectified: 85 – 264V_{RMS}
Output Voltages	24V and 48V isolated and regulated outputs
Output Power	400W
Efficiency	Up to 92%
Dimensions	PFM 4414: 111 x 36 x 9.4mm PFM 4914: 125 x 36 x 9.4mm
DCM™ DC-DC Converter Module	
Input Voltages	9 – 50V_{DC}, 16 – 50V_{DC}, 18 – 36V_{DC}, 36 – 75V_{DC}, 120 – 420V_{DC}, 160 – 420V_{DC}, 200 – 420V_{DC}
Output Voltages	5V, 12V, 13.8V, 15V, 24V, 28V, 36V, 48V
Output Power	4623 ChiP: Up to 600W 3623 ChiP: Up to 320W 3714 VIA: Up to 600W 3414 VIA: Up to 320W
Efficiency	Up to 93%
Dimensions	4623 ChiP: 47.91 x 22.8 x 7.26mm 3623 ChiP: 38.72 x 22.8 x 7.26mm 3714 VIA: 95.3 x 35.6 x 9.4mm 3414 VIA: 85.9 x 35.6 x 9.4mm
PI31xx Isolated DC-DC Converter Modules	
Input Voltages	48V (36 – 75V) Comms 28V (16 – 50V) M-Grade 24V (18 – 36V) Industrial
Output Voltages	3.3V, 5V, 12V, 15V, 18V
Output Power	50W / 60W (dependent on model)
Efficiency	Up to 87%
Dimensions	22 x 16.5 x 6.7mm