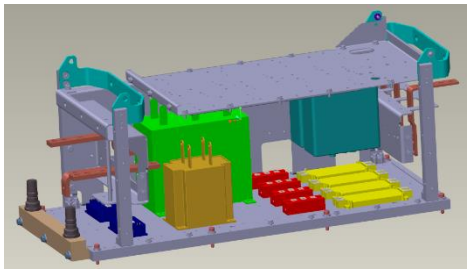
High Voltage DC-DC 100kW Power Converter Module

The main purpose of the DC-DC converter module will be to provide stable and isolated DC output for power conversion applications. This module will be lighter and compact with reduced losses compared to legacy designs thereby contributing to a greener use of energy.

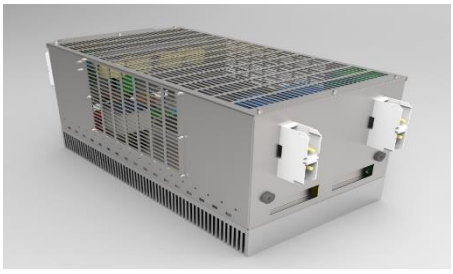
The DC-DC converter module uses cutting edge Silicon Carbide (SiC) MOSFET power devices. Two versions are being designed with high input voltage and higher power conversion of up to 100kW. Version 1 is designed to work in the input voltage range between 500Vdc to 1000Vdc. Version 2 is designed to work in the input voltage range between 1000Vdc to 2000Vdc. Both these versions are galvanically isolated between the DC input and output. The converter module accepts a wide input voltage variation and produces a stable fixed DC output voltage of up to 650Vdc.

The intended application is principally for power conversion and isolation on board rail vehicles. Other applications include power distribution as a means of galvanic isolation or as a solid state transformer (SST). Electrical / mechanical robustness, high efficiency, low weight and compact dimensions are key requirements for the railway industry and this module is designed with all these objectives in mind. There are different versions available that cover variable input voltages, various cooling arrangements and variable conversion power/voltage outputs. In short these modules can be tailored to meet customer requirements.



Liquid ‘cold plate’ 100kW power module

Forced air cooled 100kW power module



Naturally cooled 50kW power module

The use of SiCs offer performance enhancements in high power conversion applications that have not been previously achieved with Insulated Gate Bipolar Transistors (IGBTs). SiC devices provide the opportunity to reduce the space envelope, reduce the weight and improve the power conversion efficiency. These devices far outperform all previous power device technologies in terms of switching speed and thermal losses.

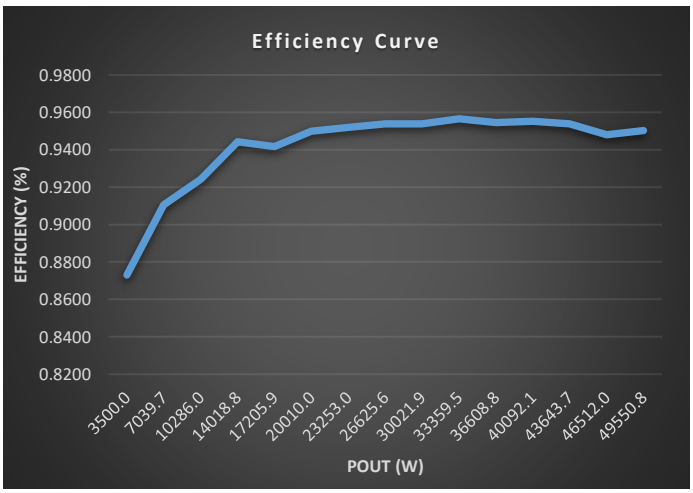
Key Features and Benefits

- ✓ Higher conversion efficiency 95% - 97% at full load
- ✓ Wide input voltage range
- ✓ High frequency operation - 20 kHz operation means audible noise due to magnetostriction effects are reduced
- ✓ Smaller magnetic components are used
- ✓ A smaller and lighter construction than was previously obtainable
- ✓ The module is capable of series or parallel operation for increased power capacity or higher voltage input
- ✓ Input and output L/C filters are incorporated
- ✓ All functions and safety boundaries are microprocessor controlled
- ✓ Advanced diagnostics and monitoring feature available
- ✓ Open chassis construction with aluminium panels and aluminium heatsink
- ✓ Temperature range -25°C to +45°C

Performance Schedule	Variant 1	Variant 2
Type	High frequency transformer isolated	High frequency transformer isolated
Input Voltage RANGE	500Vdc to 100Vdc	1000Vdc to 2000Vdc
Input output voltage isolation	3.5kV rms	5kV rms
Input overvoltage transient capability with no output	1400Vdc	2500Vdc
Frequency of operation	Fixed at 20 KHz	Fixed at 20 KHz
Output voltage	650 Vdc	650Vdc
DC Output Power	Up to 100kW	Up to 100kW
Weight	66 kgs	66 kgs
Dimensions	750mm (l) x 350mm(w) x 250mm(h)	750mm (l) x 350mm(w) x 250mm(h)
Cooling	<50kW output natural air cooling. >50kW to <100kW forced air cooling.	<50kW output natural air cooling. >50kW to <100kW forced air cooling.
Designed to meet Compliance Standards	EN 50121-1, EN 50121-3-1 , EN 50121-3-2, EN 50155 , EN 50163, EN 61287-1, EN 61373 , IEC 60571	

Input / Output Power Conversion Efficiency for up to 50kW Output

Input Voltage	Input Current	Output Current	Output Voltage	Pin (W)	Pout (W)	Efficiency (%)
707	0.72	5.0	700	509.0	3500.0	0.8730
705	0.98	10.1	697	690.9	7039.7	0.9106
715	1.18	14.8	695	843.7	10286.0	0.9242
720	1.15	20.2	694	828.0	14018.8	0.9442
725	1.47	24.9	691	1065.8	17205.9	0.9417
728	1.45	29.0	690	1055.6	20010.0	0.9499
724	1.62	33.7	690	1172.9	23253.0	0.9520
728	1.77	38.7	688	1288.6	26625.6	0.9538
715	2.03	43.7	687	1451.5	30021.9	0.9539
708	2.14	48.7	685	1515.1	33359.5	0.9566
702	2.48	53.6	683	1741.0	36608.8	0.9546
696	2.70	58.7	683	1879.2	40092.1	0.9552
709	2.98	63.9	683	2112.8	43643.7	0.9538
712	3.58	68.4	680	2549.0	46512.0	0.9480
715	3.63	73.3	676	2595.5	49550.8	0.9502



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