

FOR IMMEDIATE RELEASE

Development of 3.3kV compact SiC hybrid module for rail car inverters

- Size decreased to $\frac{2}{3}$ of conventional modules using Si -

Tokyo, March 15, 2012 --- Hitachi, Ltd. (NYSE: HIT / TSE: 6501, "Hitachi") today announced the development of a compact 3.3kV/1200A (ampere) hybrid module for rail car inverters having a high voltage resistance of 3.3kV using SiC (silicon carbide), a material receiving much attention as the next generation power device material replacing Si (silicon). The hybrid module developed combines 3.3kV SiC-SBDs (Schottky barrier diode) and Si-IGBTs (Insulated gate bipolar transistors). To achieve a compact size module, Hitachi developed optimization technologies for the SiC-SBD structure and the Si-IGBT device characteristics taking full advantage of device, circuit and loss simulations, and succeeded in reducing the module size to approximately two-thirds that of current Si modules (Hitachi comparison). The 3.3kV compact hybrid module developed will contribute to the decrease in size, weight and power consumption of high voltage rail car inverters which draw from 1500V overhead wires.

In recent years, environmental measures are being undertaken on a global scale to achieve a low carbon society to preventing further global warming. There is a growing market for railways as a transport system with low environmental impact but there is also a need for compact environment-friendly rail car power modules which will contribute to decreasing the size and weight of inverters for rail cars.

Compared to the currently prominent Si, the breakdown field strength of SiC is nearly 10 times higher. The high voltage resistance allows resistance loss during conduction (ON), resulting from a thinning of the device, to be reduced thus gathering attention as a candidate material for smaller power modules or simpler cooling systems. Current domestic rail inverters are mainly designed for a high voltage of 1500V from overhead wires and therefore downsizing of high voltage power modules is important. In 2009, Hitachi developed 3kV-class SiC-SBDs which employ a JBS (Junction Barrier Schottky) structure that combines Schottky junctions with pn (positive-negative) junctions, and mounted these in a power module, which led to the development of this compact SiC hybrid module for railcar inverters. Features of the technology developed are as below:

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(1) SiC-SBD structure optimization technology

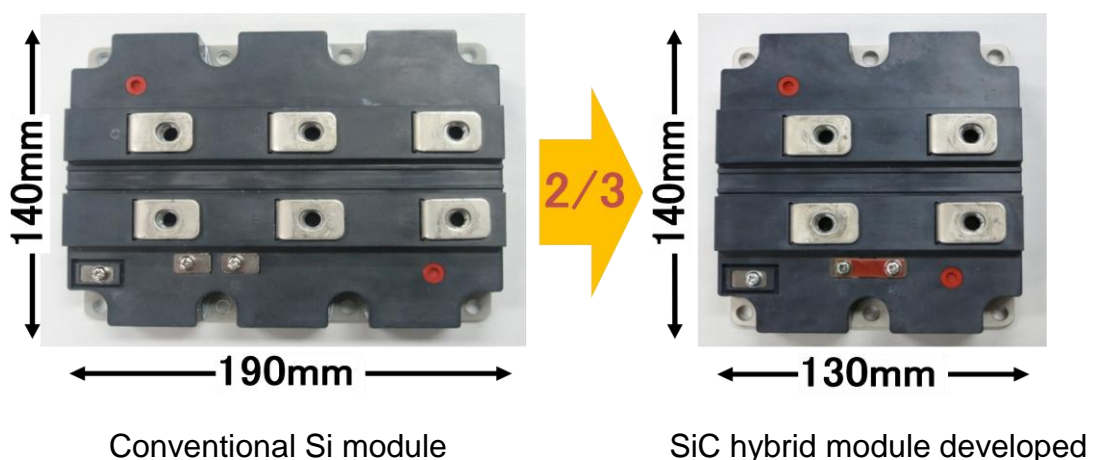
To achieve a compact power module, it is necessary to pass a large current across the SiC-SBD which has a limited surface area. By employing the JBS structure which combines Schottky junctions and p-n junctions, both conduction loss and leakage current can be reduced. This effect was further enhanced by applying device simulation to optimize the JBS structure successfully resulting in increased current per SiC-SBD surface unit area. Further, as the internal electric field of SiC is approximately 10 times that of Si, the optimal device edge structure was designed through device simulation to decrease the electric field around the device edge and assure the necessary reliability for rail cars.

(2) Si-IGBT device characteristic optimization technology

Si-IGBT device characteristics were optimized by applying circuit and loss simulation in rail application circuits. The compact 3.3kV/1200A hybrid module was achieved by combining this Si-IGBT with the SiC-SBD developed. This hybrid module developed is two-thirds the size of conventional Si module, This hybrid module simplifies the circuit structure to a simple 2 level* structure for the large market of 1500V overhead wire inverters in rail systems.

Notes

* 2 level: A method which sets the output voltage at either 0% or 100% by switching the IGBT ON or OFF, thereby reducing the number of modules required in an inverter.



About Hitachi, Ltd.

Hitachi, Ltd., (NYSE: HIT / TSE: 6501), headquartered in Tokyo, Japan, is a leading global electronics company with approximately 360,000 employees worldwide. Fiscal 2010 (ended March 31, 2011) consolidated revenues totaled 9,315 billion yen (\$112.2 billion). Hitachi will focus more than ever on the Social Innovation Business, which includes information and telecommunication systems, power systems, environmental, industrial and transportation systems, and social and urban systems, as well as the sophisticated materials and key devices that support them. For more information on Hitachi, please visit the company's website at <http://www.hitachi.com>.

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