

**MITSUBISHI ELECTRIC CORPORATION**  
**PUBLIC RELATIONS DIVISION**  
 7-3, Marunouchi 2-chome, Chiyoda-ku, Tokyo, 100-8310 Japan

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**No. 2811**

*Customer Inquiries*

*Media Inquiries*

Railway Transportation  
 Public Utility Systems Group  
 Mitsubishi Electric Corporation  
<https://www.MitsubishiElectric.com/ssl/contact/bu/transportation/form.html>  
<http://www.MitsubishiElectric.com/products/transportation/>

Public Relations Division  
 Mitsubishi Electric Corporation  
[prd.gnews@nk.MitsubishiElectric.co.jp](mailto:prd.gnews@nk.MitsubishiElectric.co.jp)  
<http://www.MitsubishiElectric.com/news/>

**Mitsubishi Electric to Launch Railcar Traction Inverter  
 with All-SiC Power Module**

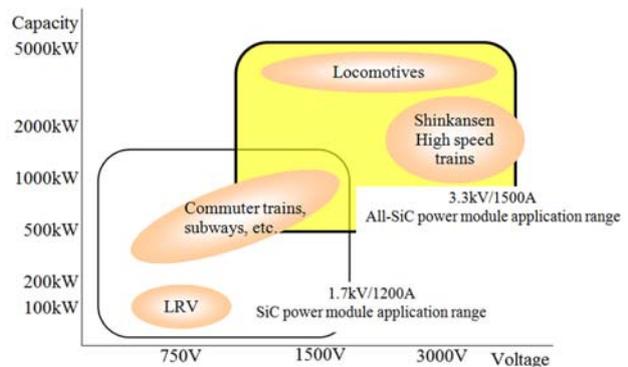
*3.3kV, 1,500A inverter suitable for high power trains*

**TOKYO, December 25, 2013** – [Mitsubishi Electric Corporation](http://www.mitsubishielectric.com) (TOKYO: 6503) announced today that it has launched a railcar traction inverter system for 1,500V DC catenaries that incorporates the world’s first all-silicon carbide (SiC) power modules made with SiC transistors and SiC diodes. The all-SiC inverter greatly reduces power loss, size and weight compared to conventional insulated gate bipolar transistor (IGBT) power modules and hybrid power modules made with Si transistors and SiC diodes.

Mitsubishi Electric’s large-capacity, all-SiC power modules are expected to help save power as well as lower the size and weight of equipment used in high power trains including Japan’s Shinkansen.



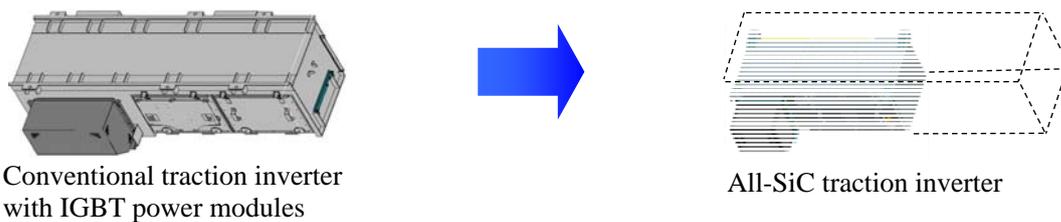
Railcar traction inverter with all-SiC power modules



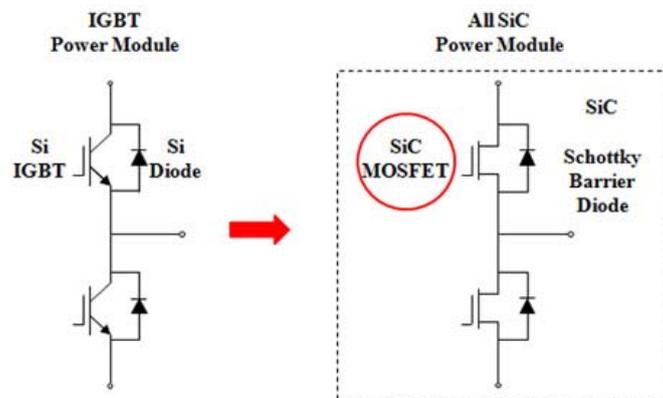
SiC application range

The new traction inverter system’s switching loss is approximately 55% less than Mitsubishi Electric’s conventional inverter system incorporating IGBT power modules. The new system also increases regenerated energy through the use of regenerative brakes in all speed ranges. Thanks to these solutions, total energy consumption of railcar systems, including their motors, is reduced by about 30% compared to conventional systems.

Size and weight are reduced by about 65% compared to conventional inverter systems with IGBT power modules and about 30% compared to existing hybrid inverter systems with SiC diodes.



The number of components is reduced by integrating SiC transistors and diodes into one package per inverter circuit phase.



Energy saving in total railway systems is further enhanced by effectively transferring regenerated electric power from the railcar to stations to be equipped with Station energy-saving inverters (S-EIV).

**Main specifications of new traction inverter system**

- Input voltage: 1,500V DC
- Main circuit system: Two-level PWM inverter with regenerative brakes
- Control system: Four traction motors with 180kW, parallel control
- Cooling system: Self-cooling

## **Background**

The dielectric strength voltage of SiC is about 10 times greater than that of Si. SiC devices can operate at higher temperatures than Si devices because of the high breakdown voltage and low conduction loss of thinner semiconductors. Unlike the ongoing development of SiC diodes, development of SiC transistors has proven difficult due to problems with crystal preparation, which requires highly advanced insulation and package technologies capable of withstanding high temperatures. Mitsubishi Electric's R&D and production units combined their respective expertise in semiconductor development and manufacturing to successfully develop the new large-capacity, all-SiC power module with MOS-FET for use in the world's first all-SiC railcar traction inverter.

Development of SiC power modules has been partially supported by Japan's New Energy and Industrial Technology Development Organization (NEDO).

## **Mitsubishi Electric's previous record of SiC inverter development**

In October 2011, Mitsubishi Electric produced a railcar traction inverter for 600V DC, 750V catenaries incorporating the world's first large-capacity hybrid SiC power modules. With help from Tokyo Metro Co., Ltd., the system was field-tested in commercial railcars operating on its Ginza Line subway, demonstrating 38.6% energy reduction comparing to conventional inverters in other railcars operating on the same line.

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## **About Mitsubishi Electric Corporation**

With over 90 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Embracing the spirit of its corporate statement, Changes for the Better, and its environmental statement, Eco Changes, Mitsubishi Electric endeavors to be a global, leading green company, enriching society with technology. The company recorded consolidated group sales of 3,567.1 billion yen (US\$ 37.9 billion\*) in the fiscal year ended March 31, 2013. For more information visit <http://www.MitsubishiElectric.com>

\*At an exchange rate of 94 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2013