Large-capacity hybrid SiC power module

A traction inverter incorporating large-capacity hybrid SiC power modules mounted on a railcar has demonstrated its energy saving effect in commercial operation.

R&D category	Transportation
Purpose, feature or effect of the R&D	Envlronmental Measure, Energy Savings, Small Package

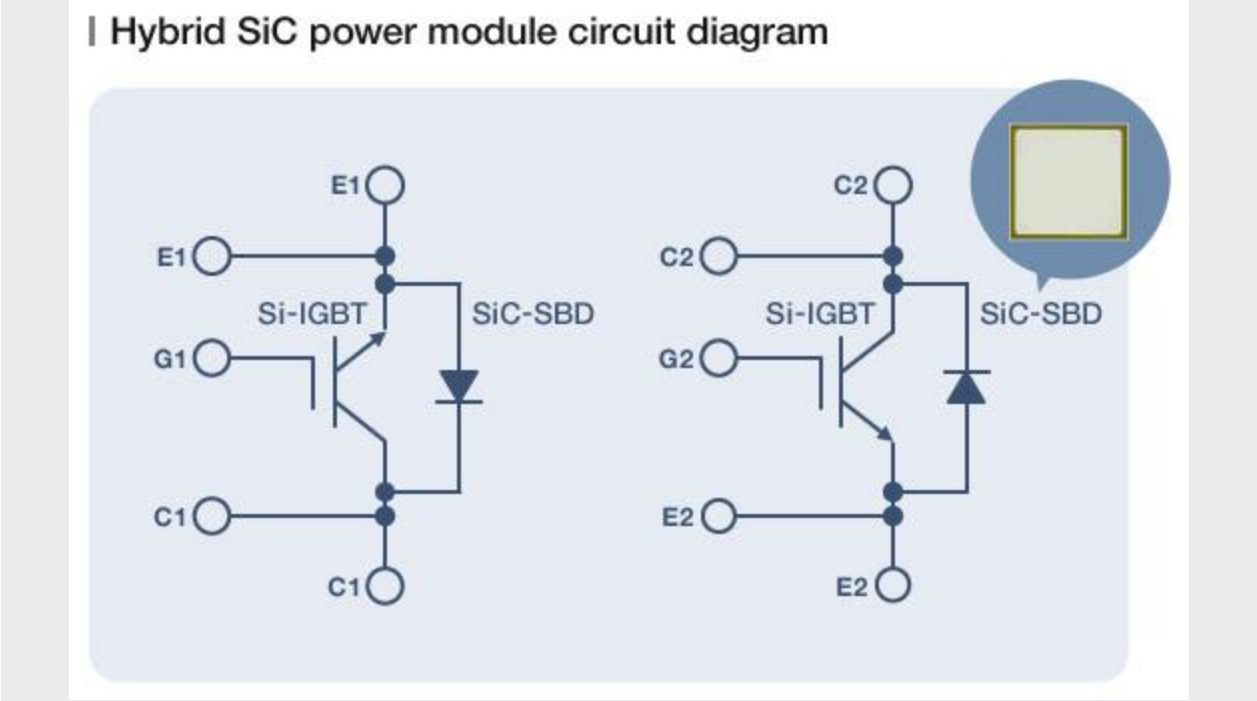
Overview

Hybrid SiC power module

Mitsubishi Electric has developed a large-capacity hybrid SiC[*1] power module, and has commercialized a railcar traction inverter that incorporates these power modules as a world-first achievement.
A railcar equipped with the inverter has been in commercial operation since February 2012, and it has demonstrated for the first time in the world[*2] the energy saving effect that can be achieved with SiC power modules.

About the Technology

Development of the large-capacity hybrid SiC power module



A large-capacity power module with a rating of 1200A/1700V was developed by configuring a hybrid structure that combines SiC-SBD*3 and Si-IGBT*4.
This hybrid SiC power module records the world's largest capacity*5 in the category of IGBT module that incorporates SiC-SBD.

Commercialization of a railcar traction inverter incorporating SiC modules

Railcar traction inverter incorporating a SiC power module
By incorporating large-capacity SiC power modules, power loss can be reduced to 30% of conventional inverters.
The SiC inverter is also 40% smaller and lighter than conventional inverters.

World's first demonstration of energy saving, through use of a commercially operating railcar

Tokyo Metro Ginza Line 01 series railcar that was used in the demonstration test for energy conservation

The SiC inverter was put in operation in February 2012 onboard a commercially operating Tokyo Metro Ginza Line 01 series railcar. In a field test, a 38.6% reduction in energy use*6 was demonstrated in comparison with conventional inverters in other railcars operating on the same Ginza line. Moreover, with an increase in regenerative ratio to 51.0%, higher energy utilization efficiency has been achieved than ever before.

This was the world's first demonstration of the energy saving effect of a railcar traction inverter incorporating SiC power modules using a commercially operating railcar.

Notes

1. *1SiC (Silicon Carbide): A compound of carbon and silicon in a 1:1 ratio
2. *2As of February 2012 according to an internal survey
3. *3SBD (Schottky Barrier Diode): A diode that utilizes the Schottky barrier formed at the semiconductor-metal junction
4. *4IGBT: Insulated Gate Bipolar Transistor
5. *5As of January 2010 according to an internal survey
6. *6Includes the energy saving effect achieved by modifying the regenerative brake system

The above development utilizes, in part, the results of a study conducted under contract from New Energy and Industrial Technology Development Organization (NEDO) of Japan.