



Using induced conductor plate

Power module parasitic inductance reduction technology



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Background of Technology Development

- Power modules, which are switching devices that convert DC power into AC power, are used in various industries, and in the case of railroad vehicles that require high power supply, a power module with switching elements connected to several insulated and stacked bus plates is connected and used to control the running speed and force of the vehicle
- When current flows inside the power module, a surge voltage is generated during the switching operation of the power module due to the current inside the power module and the parasitic inductance component in the conductor, which causes deterioration of the characteristics of the switching element

Technology Overview

- Power module parasitic inductance reduction technology to reduce parasitic inductance inside the power module by installing an inductive conductor plate on the upper part of the power module to induce leakage magnets due to current inside the power module to the upper inductive conductor plate when driving the power module

Technology Realization

- Attach an inductive conductor plate sized to cover the internal current route of the power module as closely as possible to the upper side of the power module
- When electricity is supplied to the power semiconductor switching element of the power module and electricity flows through the power module, an induction current flowing in the opposite direction to the current flowing inside the power module is generated in the induction conductor plate. The magnetic flux caused by the current flowing in the power semiconductor switching element and the magnetic flux caused by the current induced in the inductive conductor plate are mutually canceled to minimize the parasitic inductance of the power semiconductor switching element

Characteristics of the Technology Developed

The limitation of existing technologies

- If the parasitic inductance is large in the power module handling high current, the power semiconductor switching element generates a high surge voltage in the off state, and the operating voltage of the power semiconductor switching element cannot be used sufficiently. If an expensive switching element with a very high operating voltage is not used, the switching element applied to the power module is highly likely to be damaged



Characteristics of the technology developed

- Reliability of the system can be improved by reducing the parasitic inductance generated inside the power module and effectively reducing the surge voltage that occurs when the power semiconductor switching element is turned off
- In the case of high-speed switching devices such as SiC devices, the switching turn-on and turn-off times can be reduced, thereby improving the power conversion efficiency of the system



[Full-SiC power module with inductive conductor plate applied]



Technology Readiness Level

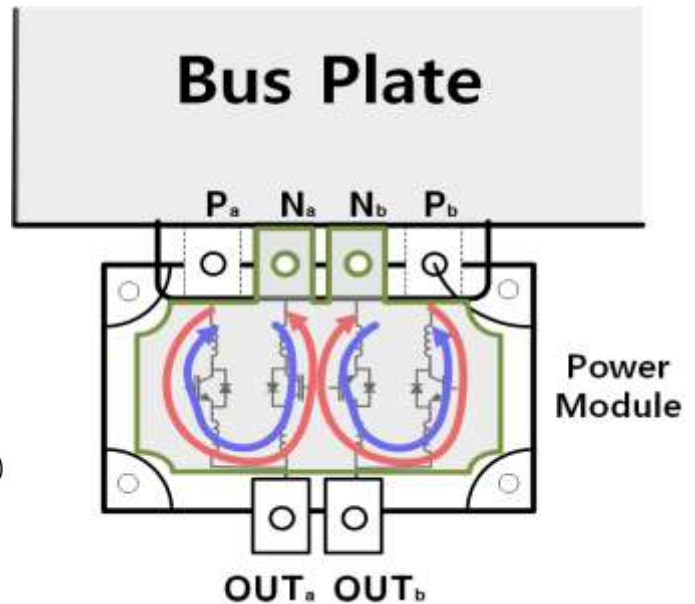
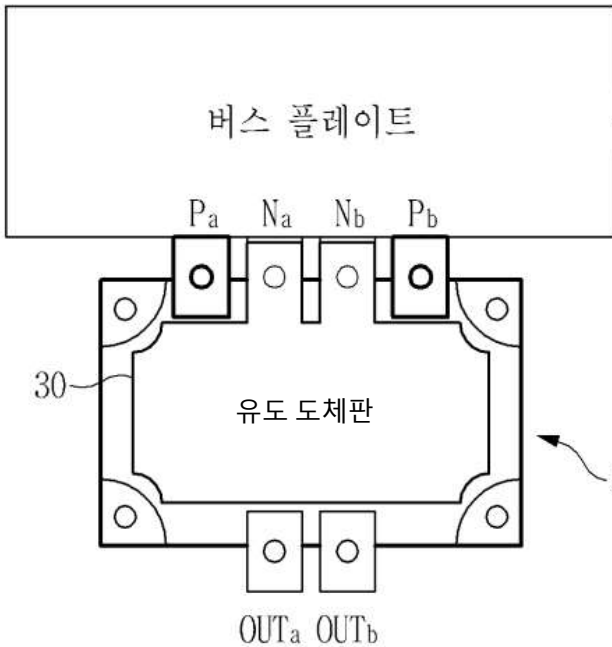
TRL1	TRL2	TRL3	TRL4	TRL5	TRL6	TRL7	TRL8	TRL9
Basic principles and experiment	Technology concept formulated	Experimental proof of concept	Component and/or system validation in lab	Performance test of trial manufactured goods	Performance test of pilot-level prototype	Reliability evaluation of pilot-level prototype	Certification and standardization of prototype	Commercialization

※ TRL 6 : Performance test of pilot-level prototype

Application Fields of Technology

- Propulsion inverter power stack module for electric railway vehicles
- High efficiency Inverter power stack for renewable energy
- Power converter based on Full-SiC Modules

Main Drawings and Photos



[Power module and inductive conductor plate connection structure]

[Current flow (Red) inside the power module and Induction Current (Blue) Flow Chart]

Current State of Intellectual Property Rights

No.	Patent Name	Date of Application	Patent No.	Note
1	Device for Reducing Parasitic Inductance of Power Module Using Induced Conductor Plate	2018-09-21	10-2182741	Registered
2	Busplate Having Function of Reducing a Stray Inductance and Power Stack Comprising the Same	2016-08-23	10-1887266	Registered