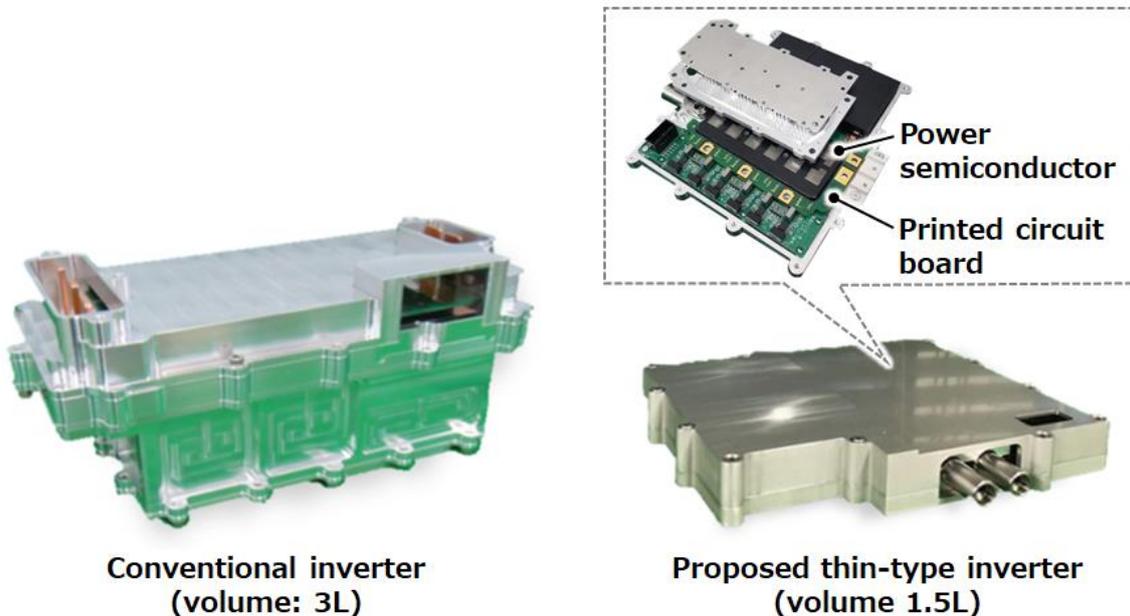


News Release

FOR IMMEDIATE RELEASE

Hitachi and Hitachi Astemo Developed Thin-type Inverter Technology for EVs That is More Compact and Energy Efficient

New structure with simplified wiring improves production efficiency and reduces CO₂ emissions



Appearance of conventional and proposed inverters

Tokyo, May 24, 2022 – Hitachi, Ltd (TSE: 6501, "Hitachi") and Hitachi Astemo, Ltd. ("Hitachi Astemo") have developed basic technology for a thin-type inverter that achieves both energy conservation and miniaturization as a power converter (hereinafter referred to as "inverter") for electric vehicles (hereinafter referred to as "EVs"). This technology simplifies power wiring by integrating power semiconductors^{*1} that control power supply with printed circuit boards. Compared to conventional products, the thin-type inverter reduces energy loss when power semiconductors are switched by 30% and is approximately 50%^{*2} smaller. The new design eliminates the need for welding of power semiconductors and power wiring, and the number of components and assembly processes required are also reduced. As a result, throughout the lifecycle of the inverter, including the production process, CO₂ emissions are reduced.

Hitachi and Hitachi Astemo will accelerate efforts to commercialize the thin-type inverter technology, and Hitachi will contribute to the realization of a carbon-neutral society by applying this technology to a wide range of applications, including not only EVs but also EV fast-charging systems and power transmission systems.

^{*1} Semiconductors that can pass or stop a larger amount of power than ordinary semiconductors. Si (silicon) has been mainly used as a material, but the practical application of SiC (silicon carbide), which is high-performance and energy-saving, has been progressing. The structure of the newly developed product is based on Si power semiconductors, but it can also be applied to SiC.

^{*2} Compared to Hitachi's conventional product (100kW class).

The electrification of automobiles is rapidly advancing as the world aims towards a decarbonized society. Inverters are an essential component of EVs, converting DC power from the battery to AC power and controlling the rotation of the motor. Inverters are also important components for the effective use of energy, including fast-charging systems for EVs and power transmission systems for renewable energy. As the introduction of EVs and renewable energy increases in the future, inverters with conventional structures will require larger power

semiconductors and peripheral components to control the power supply, which will increase energy loss and complicate the assembly process.

Hitachi and Hitachi Astemo have been providing inverters for various applications to customers around the world and have now developed the basic technology for a thin-type inverter with a completely different structure. The features are as follows:

1. Technology to integrate power semiconductors and inverter circuit components with printed circuit boards

Inverters are composed of power semiconductors that turn large currents on and off, and circuit components that conduct large currents. Because power semiconductors generate heat when high current is applied, conventional structures require separate assembly of power semiconductors and inverter circuit components and their connection with wiring. As a result, the entire inverter structure is complex, making it difficult to reduce energy loss and the size of the inverter.

Hitachi and Hitachi Astemo have now developed a basic technology that avoids the problem of heat generation by integrating the power semiconductors on a printed wiring substrate that incorporates the inverter circuit components. This technology simplifies the power wiring inside the inverter and reduces inductance^{*3}, resulting in a 30% reduction in the energy loss generated when the power semiconductors switch on and off, and thus reducing heat generation. The size of the inverter is also successfully reduced by 50% compared to conventional products.

^{*3} A value that determines the magnitude of voltage induced in the wiring of AC circuit. Large inductance leads to an increase in surge voltage and energy loss.

2. Mounting technology to reduce the number of components and processes required for assembly

Conventional inverters use many copper plate components called busbars^{*4} to supply large currents to power semiconductors, which must be connected by welding or other means. This required many parts and assembly processes, making it difficult to improve production efficiency. With the mounting technology, power semiconductors and circuit components are mounted on a compact, lightweight, thin printed wiring board, successfully eliminating the need for busbars. This has greatly simplified the production process, reducing the number of components and assembly steps. The technology reduces energy consumption in the production process and contributes to the reduction of CO₂ emissions over the lifecycle of the inverter.

^{*4} A conductor to carry a large current.

The developed inverter will be exhibited at the Automotive Engineering Exposition 2022 to be held at Pacifico Yokohama from May 25, 2022.

Main specifications of the newly developed thin-type inverter

Item	Value
Volume	1.5 L
Maximum output	170 kVA
Maximum current	350 A
Power density	113 kVA/ℓ

- End -

About Hitachi, Ltd.

Hitachi drives Social Innovation Business, creating a sustainable society with data and technology. We will solve customers' and society's challenges with Lumada solutions leveraging IT, OT (Operational Technology) and products, under the business structure of Digital Systems & Services, Green Energy & Mobility, Connective Industries and Automotive Systems. Driven by green, digital, and innovation, we aim for growth through collaboration with our customers. The company's consolidated revenues for fiscal year 2021 (ended March 31, 2022) totaled 10,264.6 billion yen (\$84,136 million USD), with 853 consolidated subsidiaries and approximately 370,000 employees worldwide. For more information on Hitachi, please visit the company's website at <https://www.hitachi.com>.

About Hitachi Astemo, Ltd.

Hitachi Astemo is pursuing business enhancement and technological innovation through a strategic business portfolio consisting of the Powertrain & Safety Systems business, Chassis business, Motorcycle business, Software business and Aftermarket business. Hitachi Astemo is committed to creating social, environmental, and economic value by providing advanced mobility solutions that contribute to improving safety and comfort, and to environmental conservation to create a more sustainable society. By doing so, we contribute to improving Quality of Life and creating value for our OEM customers.

For more information, use the enquiry form below to contact the Research & Development Group, Hitachi, Ltd. Please make sure to include the title of the article.

<https://www8.hitachi.co.jp/inquiry/hqrd/news/en/form.jsp>

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