



Power Eco Family: Overview of ROHM's Power Semiconductor Lineup

1. Introduction

In recent years, global electricity consumption has steadily increased, particularly in the industrial and transportation sectors. At the same time, rising CO₂ (carbon dioxide) emissions from fossil fuel-based thermal power generation and economic activities have emerged as significant social issues. Consequently, improving energy efficiency and achieving carbon neutrality have become common goals in the pursuit of a zero-carbon society.

ROHM is committed to addressing these societal challenges through electronics by focusing on the development of power semiconductors, which play a critical role in improving efficiency in high power applications, along with providing related power solutions. This white paper highlights ROHM's power semiconductor technologies and related initiatives that contribute to creating a sustainable ecosystem under the brand concept of the Power Eco Family.

2. Market Needs and ROHM's Response

The use of electricity has been accelerating across various fields such as electric vehicles and energy harvesting, with power systems integrated into these applications increasingly required to improve efficiency and miniaturization while reducing weight. As a result, power conductors must deliver higher performance and greater resistance to severe environmental loads, specifically, fast switching, low loss, and high heat dissipation. At the same time, the application scope of power semiconductors continues to expand, driving up demand.

ROHM has accumulated extensive expertise in the power semiconductor sector over the years, including being the world's first to mass produce SiC (Silicon Carbide) MOSFETs. ROHM is also expanding into new product areas such as GaN (Gallium Nitride), which like SiC is attracting attention as a next-generation semiconductor to meet growing market demand. Figure 1 on the next page depicts the regions covered by ROHM's Eco family in terms of power capacity (vertical axis) and operating frequency (horizontal axis). Si (Silicon), a long-established semiconductor material, is utilized in the EcoMOS™ and EcoIGBT™ series of power semiconductors. Furthermore, next-generation semiconductors such as EcoSiC™ ideal for ultra-high voltage and high-speed switching, and EcoGaN™ featuring ultra-high-speed switching, are offered to address diverse application needs. ROHM has grouped these four product lines under the Power Eco Family, contributing to the development of a sustainable ecosystem by enhancing application performance. The following sections will introduce each brand in detail.

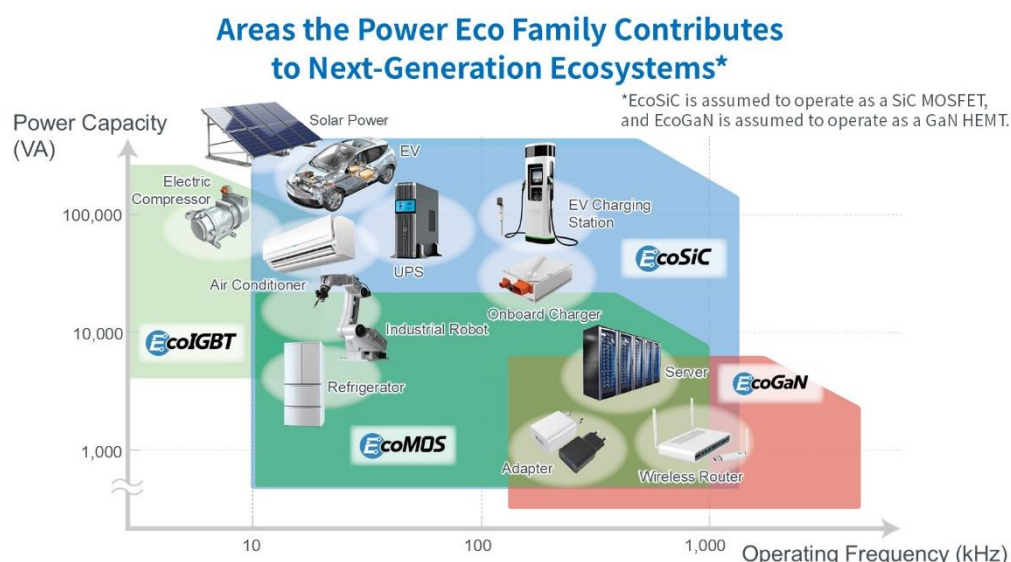


Figure 1. Diagram Showing the Area of Each Power Eco Family Product by Power Capacity and Operating Frequency

• EcoSiC™, EcoGaN™, and EcoIGBT™ are trademarks or registered trademarks of ROHM Co., Ltd.

3. The 4 Brands That Comprise the Power Eco Family

3-1. EcoSiC™

EcoSiC™ is a brand of devices that leverage SiC, a material gaining attention in the power device field for superior performance that surpasses Si.

Since becoming the first in the world to mass produce SiC MOSFETs in 2010, ROHM has cultivated essential in-house technologies for SiC devices, from SiC wafer fabrication and device structures to production processes, packaging, and quality control methods. ROHM also offers SiC devices in various forms, including bare chips, discrete devices such as SBDs and MOSFETs, and even modules. To prepare for the expanding SiC market, ROHM began manufacturing 8-inch wafers in 2023, with plans to start mass production and device shipments in 2025. In the newly established Miyazaki No. 2 Plant located in Kunitomi-cho, Miyazaki Prefecture, trial operations have already commenced on some production lines. The facility was set up quickly and efficiently by acquiring a building and cleanroom previously used as a factory by another company, with support from Japan's Ministry of Economy, Trade, and Industry (METI). Through such initiatives, ROHM is strengthening its ability to respond to the rapidly growing SiC market.

SiC adoption is accelerating in the automotive sector, particularly in traction inverters for xEVs, where demand is highest. For example, in August 2024 [ROHM announced that its bare chips were selected for use in traction inverters for GEELY's premium brand ZEEKR](#). ROHM is also focusing on module development, including the release of molded SiC modules designed specifically for traction inverters used in electric vehicles. [TRCDRIVE pack™](#), which achieves industry-leading power density that contributes to smaller, lighter inverters, is [slated for installation in Valeo's next-generation inverters](#) (Figure 2). With design wins from over 130 companies

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worldwide, ROHM's EcoSiC™ is also highly regarded for its industry-leading device technology, flexible business model, and stable supply system.

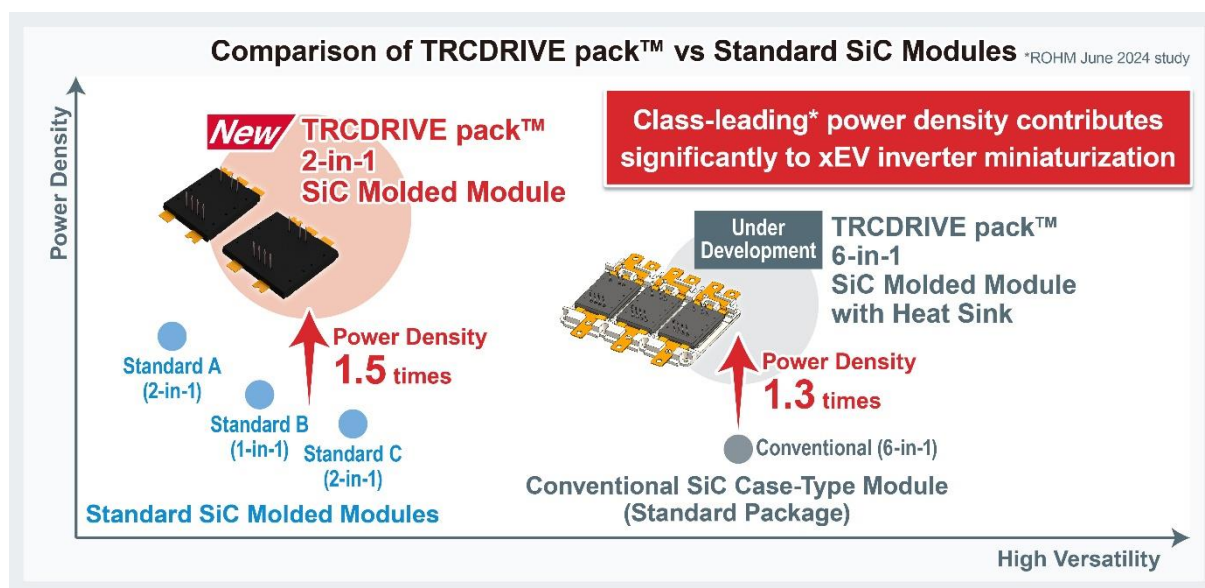


Figure 2. TRCDRIVE pack™ Achieves Class-Leading* Power Density

• TRCDRIVE pack™ is a trademark or registered trademark of ROHM Co., Ltd.

For industrial equipment, ROHM is actively targeting applications such as PV (photovoltaic) inverters, EV charging stations, and DC-DC converters. ROHM is developing 2kV-rated SiC MOSFETs for 1,500V systems, with plans to strengthen its capabilities to support high voltage industrial equipment. ROHM already offers a lineup of 650V to 1,700V SiC SBDs in both discrete and bare chip forms that are being increasingly adopted in PV inverters and the PFC sections of EV charging stations.

ROHM is also accelerating its business model of supplying SiC bare chips to module manufacturers. For example, we are strengthening [collaboration with Semikron Danfoss to provide SiC and IGBT bare chips for both automotive and industrial equipment applications](#).

In terms of product development, ROHM is working on 5th generation SiC MOSFETs, scheduled for release in 2025. These are expected to reduce ON resistance during high temperature operation by approx. 30% compared to the current 4th generation, significantly improving efficiency. ROHM is also shortening the development cycle for next-generation products and beyond to quickly respond to market changes and demands.

• Application Examples

Industrial Equipment: PV inverters, UPS (Uninterruptible Power Supplies), EV charge stations, DC-DC converters

Automotive: Traction inverters, auxiliary inverters, OBCs (onboard chargers), DC-DC converters

EcoSiC™-Related Web Pages

[EcoSiC™ Product Page](#)

[EcoSiC™ News Releases](#)

3-2. EcoGaN™

ROHM's EcoGaN™ brand leverages the unique characteristics of GaN to reduce power consumption, shrink peripheral components, and simplify designs by requiring fewer parts. The series includes GaN HEMT devices as well as GaN-equipped ICs with built-in controllers. Designed to be user-friendly, EcoGaN™ focuses on user-friendly design, making GaN technology easier to implement across various applications. This enables high-efficiency operation, contributing to the realization of a decarbonized society.

ROHM began mass production of its first EcoGaN™ product, [150V GaN HEMTs](#), 2022, followed by [650V GaN HEMTs](#) in 2023 that achieve industry-leading device performance metrics ($R_{DS(ON)} \times C_{iss}/R_{DS(ON)} \times C_{oss}$). These devices have been [adopted in Delta Electronics' Innergie brand of AC adapters, including the C4 Duo and C10 Duo](#), delivering greater efficiency while reducing size.

Compared to Si, GaN devices improve application efficiency while enabling the miniaturization of inductors and heat dissipation components. However, challenges such as the complexity of driving the gate have hindered widespread adoption. To address this, ROHM not only enhances the performance of standalone GaN HEMTs, but also incorporates them with LSIs, utilizing its expertise in analog technology to create user-friendly GaN solutions. The [BM3G0xxMUV-LB](#) power stage IC (System in Package) is the first mass-produced product under this concept, integrating a 650V GaN HEMT and gate driver in a single package, (Figure 3). This makes it easy to replace existing MOSFETs while reducing component volume and power loss by 99% and 55%, respectively.

Going forward, ROHM plans to develop [controller ICs for driving GaN devices utilizing proprietary Nano Pulse Control ultra-high-speed control technology](#) cultivated for power supply ICs, contributing to improved efficiency by promoting the adoption of user-friendly GaN devices.

ROHM also intends to mass-produce power stage ICs equipped with power factor correction (PFC) circuits and products featuring half-bridge circuits, with integrated solutions that combine GaN HEMTs, gate driver ICs, and controller ICs expected to be available by 2026. For the latest updates on EcoGaN™ solutions, including products currently under development, visit the [EcoGaN™ page](#).

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GaN devices are projected to experience rapid growth in the late 2020s, with anticipated applications in areas such as automotive onboard chargers (OBCs). ROHM has [partnered with Taiwan Semiconductor Manufacturing Company Limited \(TSMC\)](#) to develop and mass-produce automotive GaN devices, utilizing foundries and OSATs to rapidly commercialize in-vehicle GaN devices.

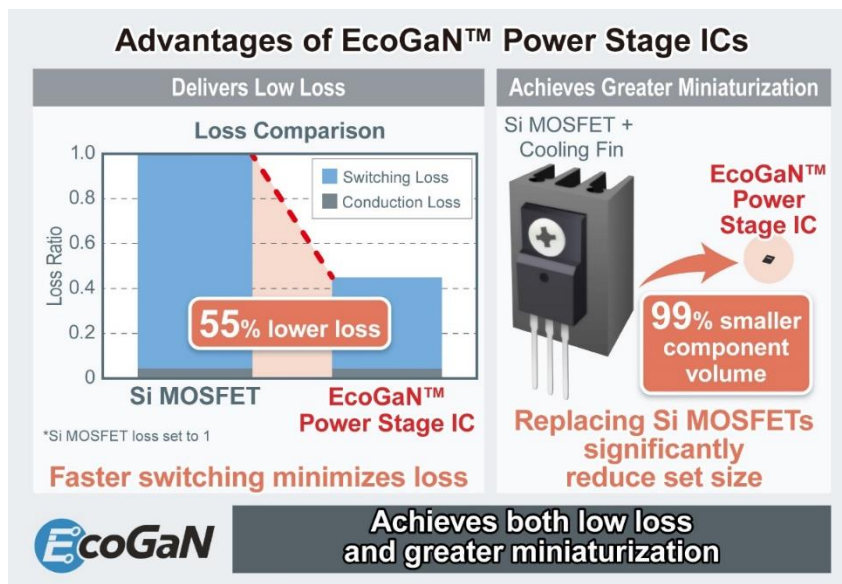


Figure 3. Power Stage IC Advantages

- Application Examples

Industrial Equipment: Power supplies for servers and base stations

Consumer: USB chargers, wireless routers

Automotive: OBCs (onboard chargers), DC-DC converters

*Products for automotive applications are currently under development and schedule for commercialization by 2026

EcoGaN™-Related Web Pages

[EcoGaN™ Product Page](#)

[EcoGaN™ News Releases](#)

[EcoGaN™ Page](#)

- Nano Pulse Control™ is a trademark or registered trademark of ROHM Co., Ltd.

3-3. EcoIGBT™

EcoIGBT™ is ROHM's brand of IGBTs encompassing both devices and modules designed to meet the needs of high-voltage applications in the power device field. Offering better cost performance than SiC MOSFETs, IGBTs remain highly sought after for cost-sensitive, high-power applications and sets with minimal miniaturization requirements. ROHM foresees continued growth in the IGBT market and is advancing technology development accordingly.

ROHM initiated research and development of IGBTs in 2010 and began mass production in 2012. Production is currently being carried out at multiple facilities, including the Shiga factory. In 2024 ROHM launched the [RGA series](#), the latest generation of 1,200V 4th Gen IGBTs (Figure 4). These

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products achieve industry-leading performance, reducing power loss by 35% compared to conventional ROHM IGBT models while extending short-circuit withstand capability to 10 μ s. This has led to their adoption and consideration for applications such as automotive electric compressors and industrial equipment inverters. These IGBTs have also been integrated into [power modules developed by Semikron Danfoss](#).

In IGBTs, it is important to optimize characteristics to meet specific application requirements. For example, short-circuit withstand capacity is prioritized for electric compressors in car AC, while reducing switching loss is emphasized for applications such as solar power inverters. ROHM addresses these needs by fine-tuning device structures and impurity concentrations to achieve an optimum balance of product characteristics. Going forward, ROHM plans to develop new products such as the 650V RGE and RGH series targeting a wide range of applications, including automotive OBCs, PV inverters for industrial equipment, and consumer AC. ROHM is also focusing on Intelligent Power Modules (IPMs) that combine IGBTs and gate driver ICs to reduce power loss and noise, thereby strengthening competitiveness in the IPM market.

ROHM has also begun development of 5th Gen IGBTs, aiming for commercialization between 2026 and 2027. For this generation, ROHM is pursuing further performance improvements by adopting an entirely new device structure, rather than building on existing technologies. Despite the increasing adoption of SiC devices, ROHM believes that the IGBT market will continue to grow, particularly in the industrial equipment and automotive sectors.

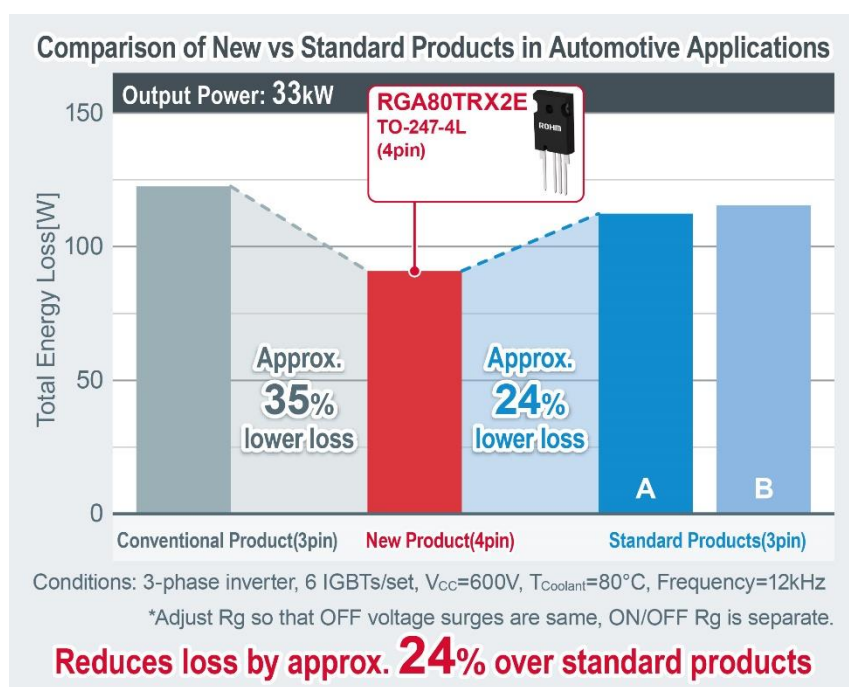


Figure 4. Comparison of Conventional/Standard/4th Gen IGBTs (RGA Series) in 3-Phase Inverters

- Application Examples

Industrial Equipment: Industrial inverters, robots

Consumer: ACs (air conditioners), refrigerators, vacuum washing machines

Automotive: Electric compressors, auxiliary inverters, HV heaters, OBCs (onboard chargers)

EcoIGBT™-Related Web Pages

[EcoIGBT™ Product Page](#)

[Eco IGBT™ News Releases](#)

[EcoIGBT™ Parametric Search Page \(Field Stop Trench Products\)](#)

3-4. EcoMOS™

EcoMOS™ is ROHM's brand of silicon power MOSFETs designed for energy-efficient applications in the power device sector. Widely utilized in applications such as home appliances, industrial equipment, and automotive systems, EcoMOS™ provides a diverse lineup that enables product selection based on key parameters such as noise performance and switching characteristics to meet specific requirements.

For instance, the [R60xxRNx series](#) reduces switching loss by approx. 30% over standard products while also delivering low noise, making it ideal for small motor applications such as refrigerators and ventilation fans where noise mitigation is critical. In addition, the [R60xxVNx series](#) improves the trade-off between reverse recovery time (t_{rr}) and ON resistance ($R_{DS(ON)}$), reducing switching loss by approx. 17% vs standard products. This makes it ideal for high power circuits in applications like EV charging stations and servers, as well as motor drives in AC where inverter adoption is progressing (Figure 5).

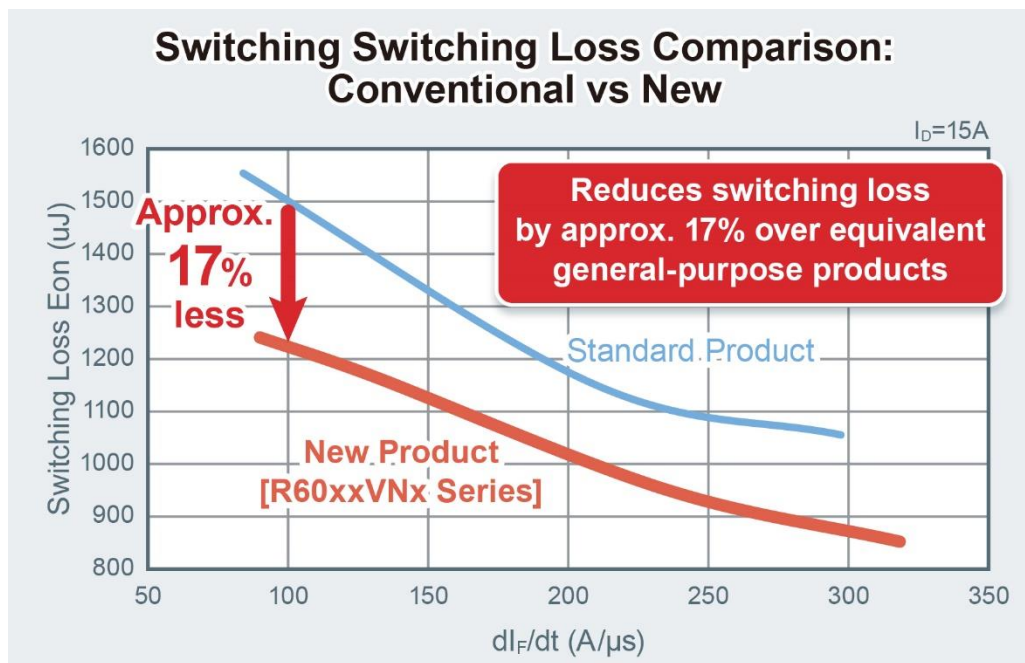


Figure 5. Switching Loss Comparison: R60xxVNx Series vs General Product

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- Application Examples

Industrial Equipment: EV charging stations, PV inverters, servers

Consumer: ACs (air conditioners), refrigerators, ventilation fans

- EcoMOS™-Related Web Pages

[EcoMOS™ Product Page](#)

[EcoMOS™ News Releases](#)

[Super Junction MOSFET Page](#)

4. Summary

This white paper introduced the four brands that make up the Power Eco Family. ROHM is committed to accelerating product development, providing technical support during application design, and ensuring stable supply across all of its brands. To achieve these objectives, ROHM is exploring strategies such as production collaboration and joint development. By promoting the miniaturization and energy efficiency of applications, ROHM aids in reducing global power consumption and material usage. And by expanding the Power Eco Family in collaboration with stakeholders, ROHM contributes to creating a sustainable ecosystem.

Ecosystem Components Centered on Product Features and Solutions

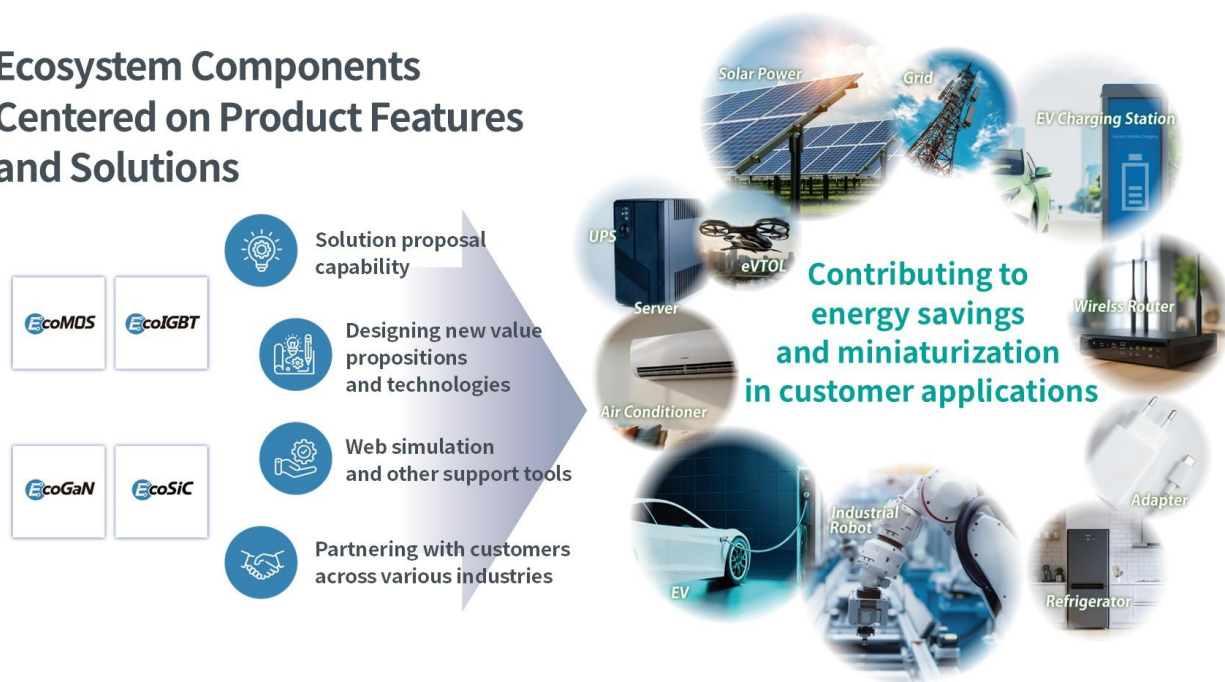


Figure 6. Building Ecosystems by Expanding the Power Eco Family

*ROHM February 2025 study

- The information contained in this document is current as of Feb. 2025.

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