



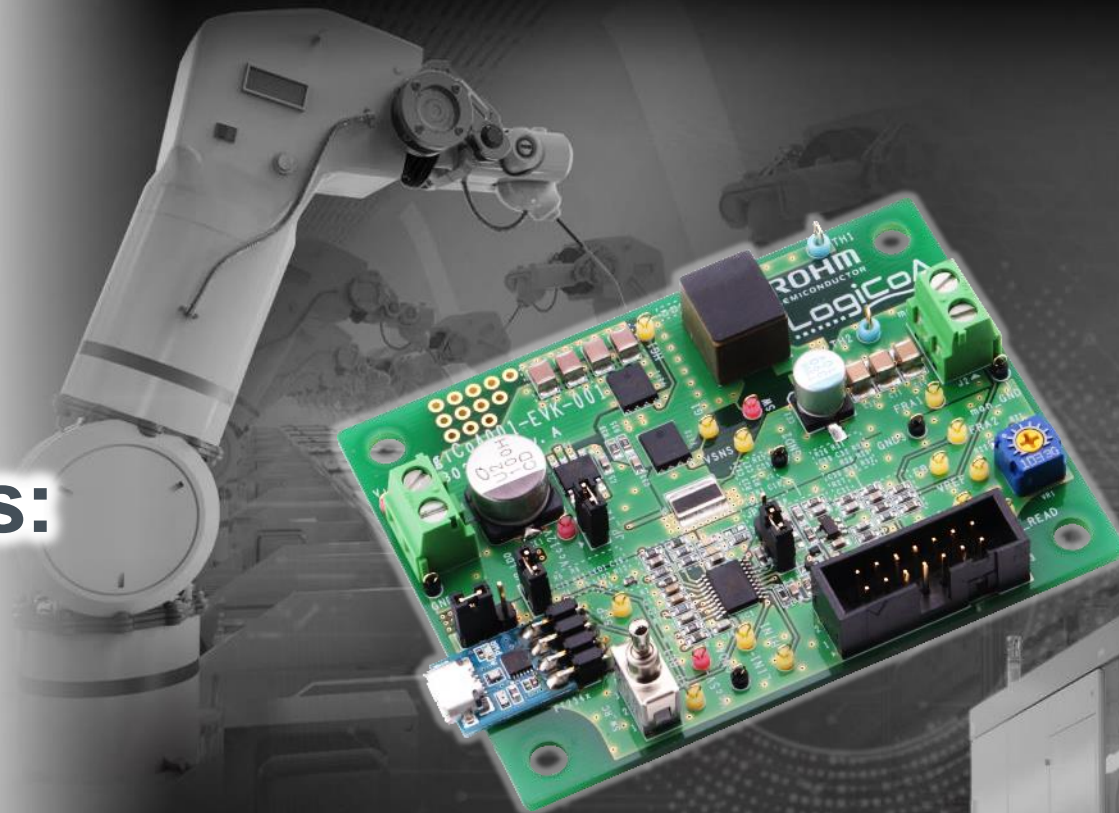
Electronics for the Future

LogiCoA

Hybrid Analog-Digital Control LogiCoA™ Power Electronics Solutions: Introductory Presentation

*LogiCoA™ is a trademark or registered trademark of ROHM Co., Ltd.

July 16, 2024
ROHM Co., Ltd.
Marketing Communications Dept.



This solution's core brand

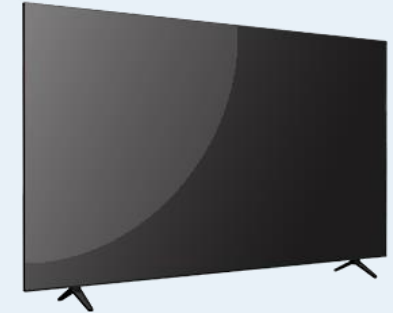


The LogiCoA™ brand represents a design philosophy that integrates digital elements to maximize the performance of analog circuits. Combining the advantages of analog and digital contributes to more efficient power utilization.

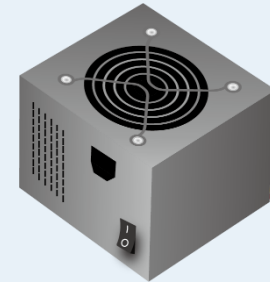
Application Examples



Industrial Power Supplies



Large-Screen TVs



Internal PSUs for Desktop PCs



Industrial Lighting

Power supplies are one of the key areas of power electronics

LogiCoA™ solutions support a wide range of applications in the power electronics field, with a focus on power supplies

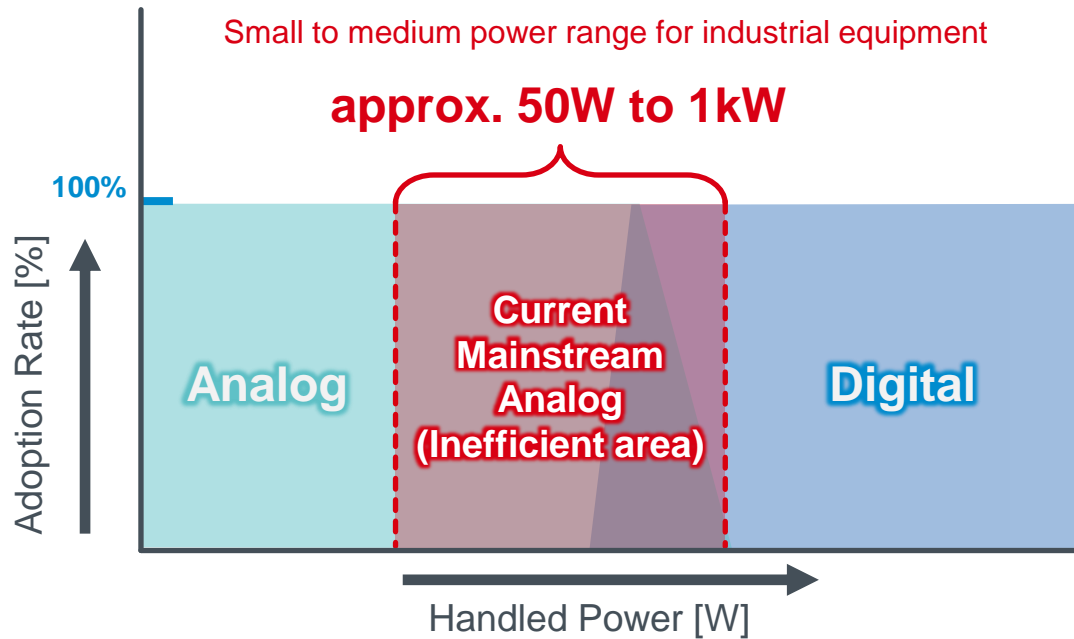
*Power electronics field: A sector dedicated to power supply, control, and power conversion

*LogiCoA™ is a trademark or registered trademark of ROHM Co., Ltd.

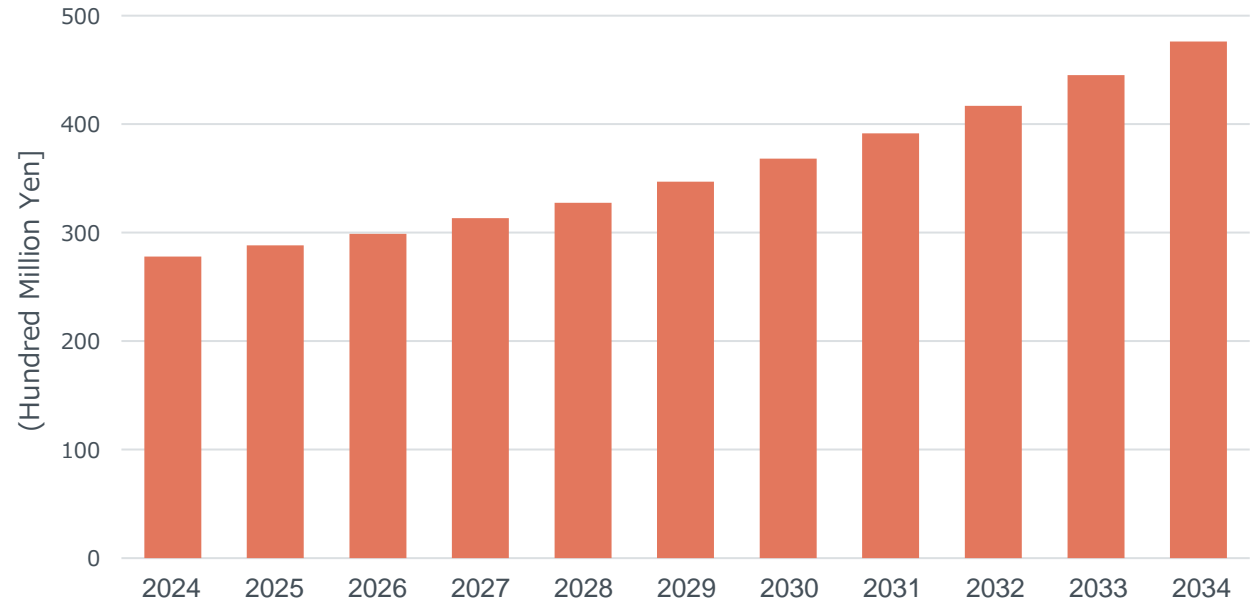
LogiCoA™'s Primary Target Market and the Trend for Industrial Power Supply Equipment

Power systems used in industrial equipment are primarily analog-controlled in the small to medium power range of approx. 50W to 1kW, while digital control is mainstream in the high-power region

Different Power Supply Control Methods Based on Power Range



Market Size for Small to Medium Power Industrial Equipment (approx. 50W to 1kW)

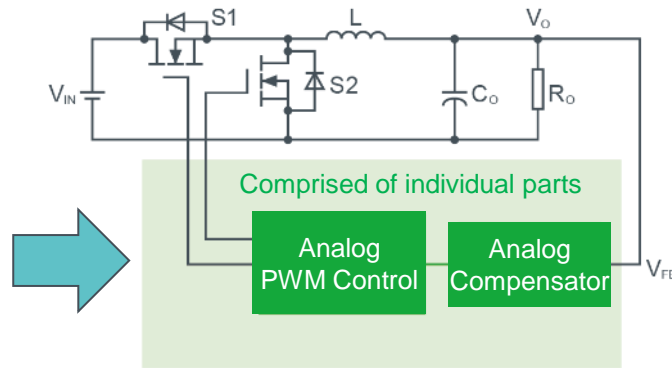


Industrial power supplies demand better power solutions in the low to medium power range.

Features and Challenges of Analog and Digital Power Control Circuits

Analog Control

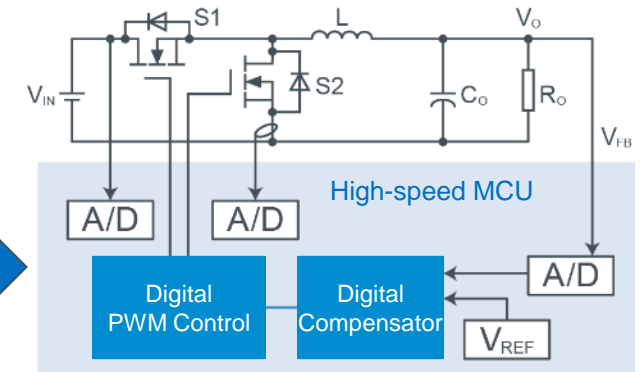
Industrial power supplies demand better power solutions in the low to medium power range.



Parameter	Analog Control	
Cost	Excellent	No need for CPU/design margins
Power Consumption	Excellent	Low ($I_{CC}=3\text{mA}$ to 5mA)
Functions	Negative	Low functionality (no complex functions)

Digital Control

High power consumption
Expensive high-speed MCU



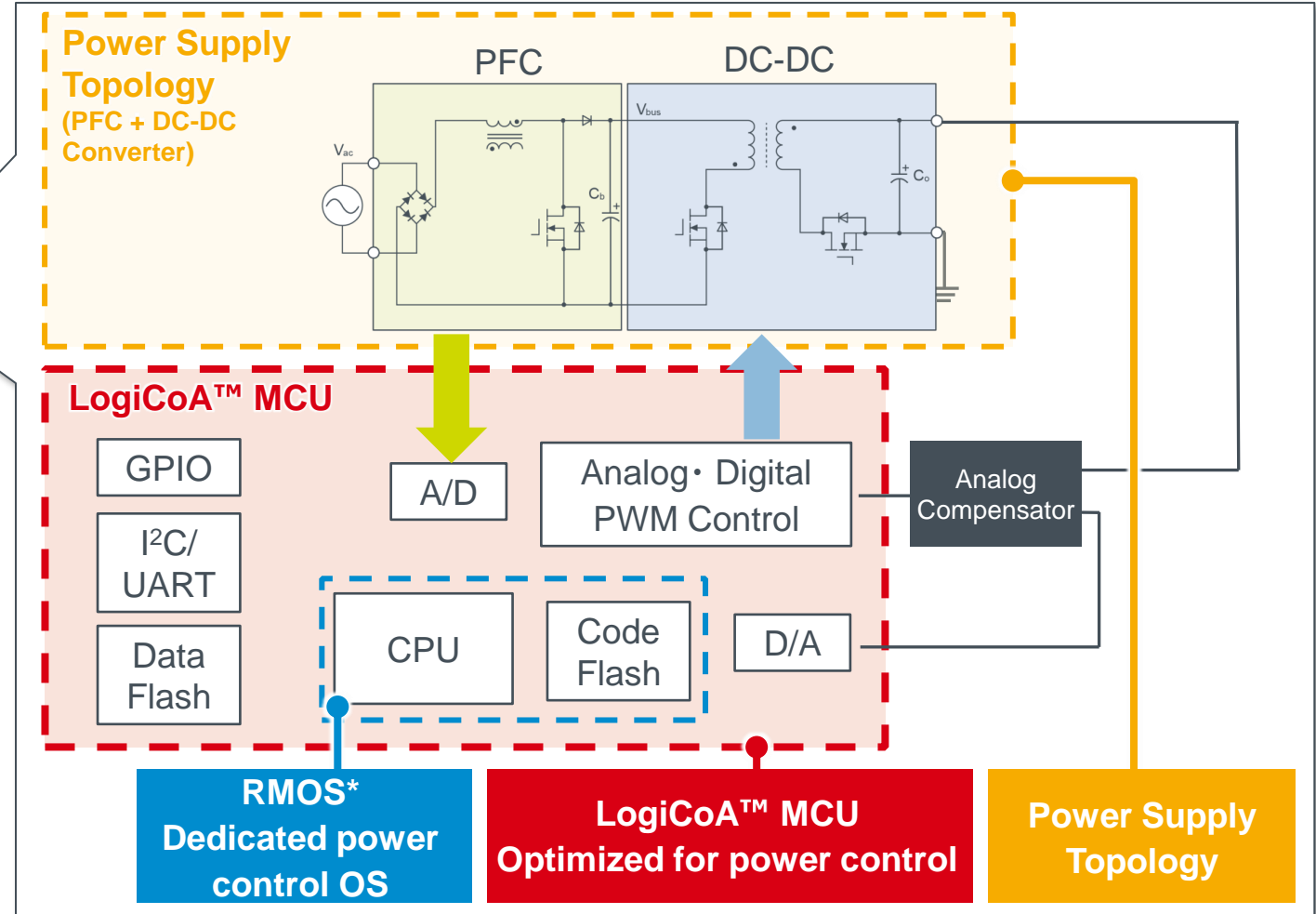
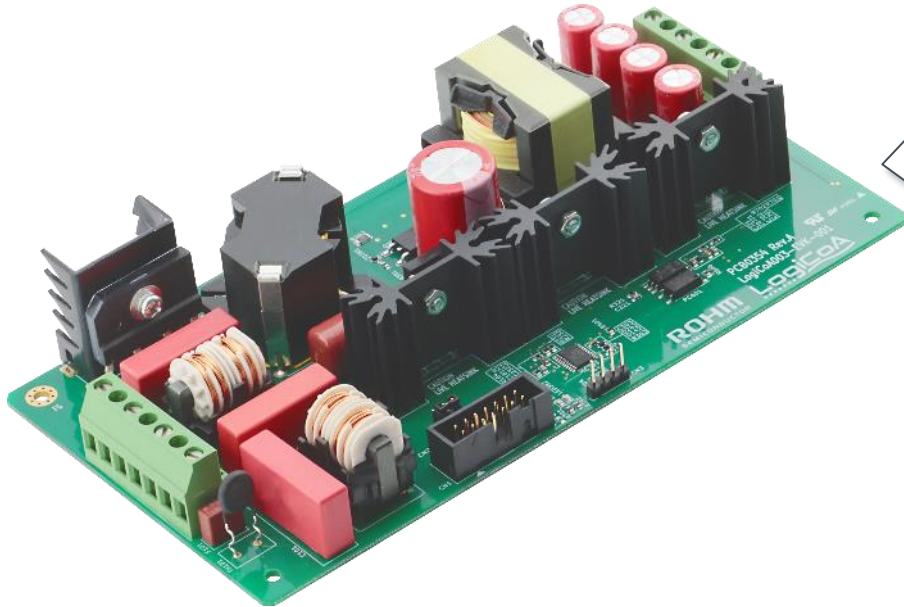
Parameter	Digital Control	
Cost	Neutral	High-speed CPU/DSP (high cost), no need for design margins
Power Consumption	Negative	High ($I_{CC}=100\text{mA}$ to 150mA)
Functions	Excellent	Functions such as calibration and log acquisition can be added

Above Issues

Analog control used in the low to medium range faces challenges in achieving high functionality, while adopting full digital control in the high-power region is costly and consumes significant power

LogiCoA™ simultaneously achieves low cost, low power consumption, and high functionality

ROHM LogiCoA™ Power Supply Solution Overview (Configuration)



LogiCoA™ power solutions, which achieve exceptional functionality while reducing cost and power consumption, consists of 3 elements: Power Supply Topology, LogiCoA™ MCU, power control OS

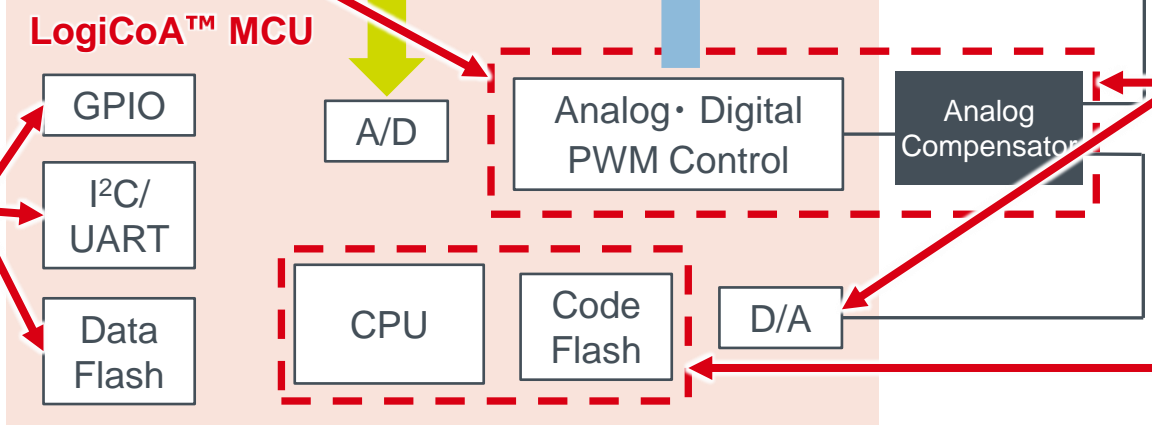
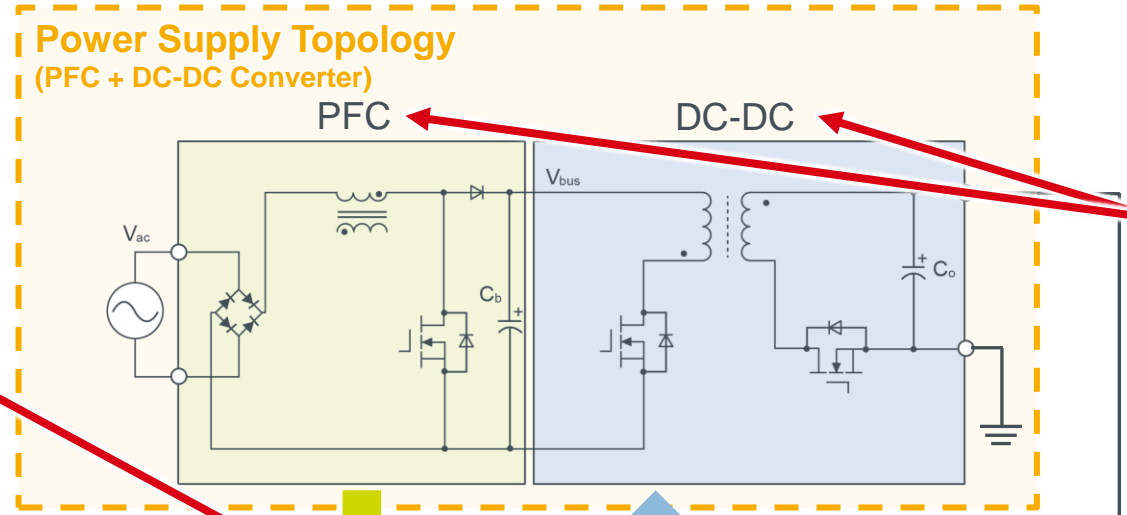
*RMOS (Real-time Micro Operating System)

*LogiCoA™ is a trademark or registered trademark of ROHM Co., Ltd.

Benefits of LogiCoA™ Power Supply Solutions

① Low cost · low power consumption (Slide 7)
 Leveraging the characteristics of both analog and digital topologies eliminates the need for high-speed operation, **enabling low power operation using a cost-effective LogiCoA™ MCU**

② Advanced functions (Slide 8)
 Incorporating log data acquisition and interface functions adds new value not possible with analog control, such as **operational status analysis**



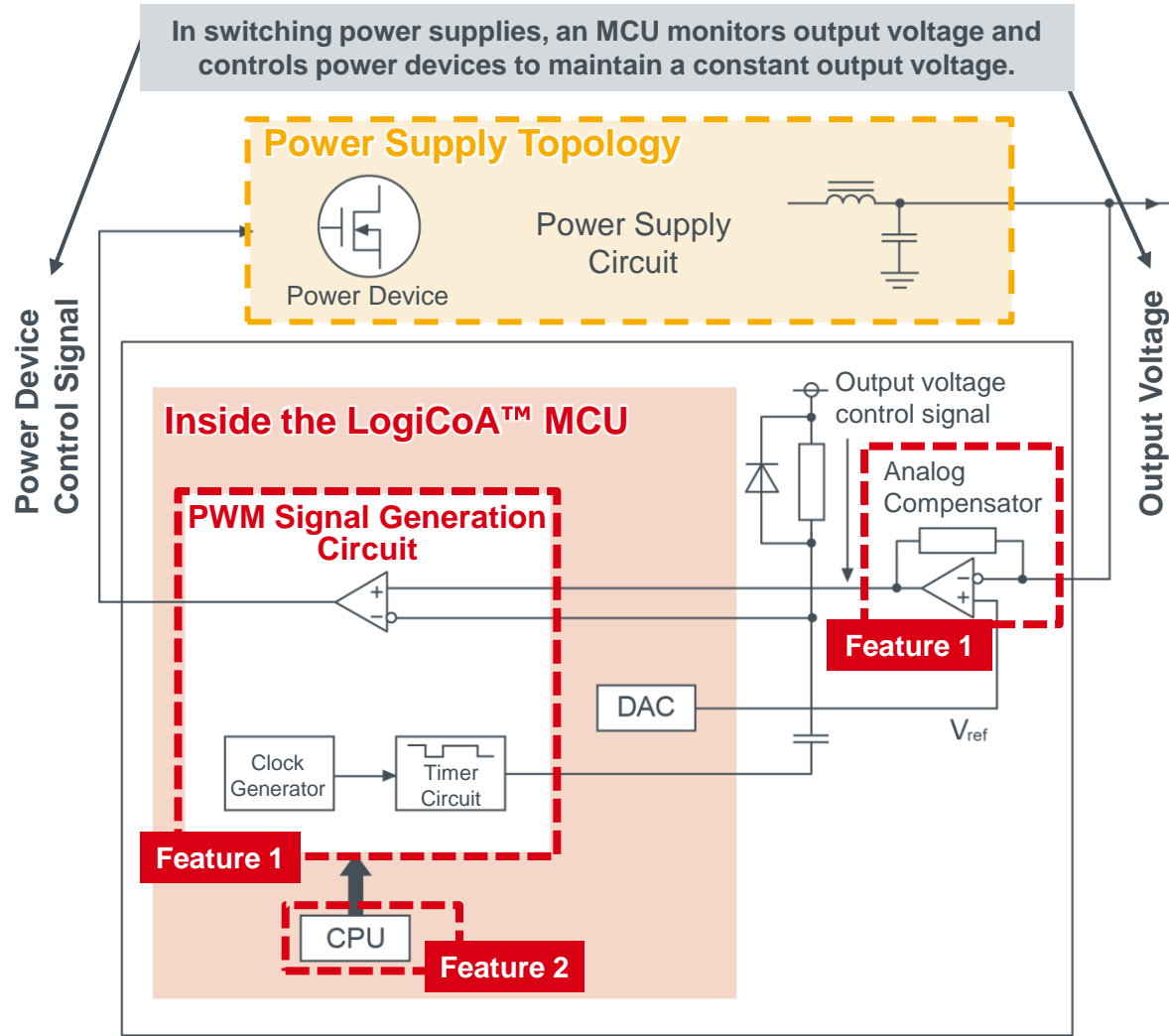
③ Low cost (Slide 9)
 The LogiCoA™ MCU and RMOS work in tandem to **simultaneously control two topologies**, contributing to greater **miniaturization and lower costs**

④ Low cost · high performance (Slide 10)
 The calibration function corrects for variations, **improving performance while reducing the size of external components**

⑤ Facilitates implementation (Slide 11)
 RMOS and reference boards for different power topologies **simplify MCU software development**

New added value by transitioning from conventional analog control to LogiCoA™ power solutions is shown in points ① to ⑤

Leveraging Analog and Digital Technologies to Achieve Fully Digital Control



Fully Digital Control

The output voltage is directly input into the MCU and processed digitally

Requires a costly, high-performance MCU that consumes significant power due to high-speed operation

LogiCoA™ Control

Feature 1
The compensator is configured in analog, and the generation of power device control signals uses a hybrid analog-digital method.

Feature 2
The LogiCoA™ MCU operates almost automatically after the initial configuration is set by the CPU

Low power operation is possible with a low-cost MCU optimized for LogiCoA™

*LogiCoA™ is a trademark or registered trademark of ROHM Co., Ltd.

Log Data Acquisition Adds New Value (i.e. Operation Status Analysis)

Collecting and analyzing log data from the LogiCoA™ MCU built into the power supply unit makes it possible to:

- Analyze abnormal operations
- Determine whether maintenance is required
- Estimate the life of the unit



PC for Control



Power Supply Equipped with LogiCoA™ Power Solution



Application Examples



Switching Hub for Industrial Equipment



Control PC for Industrial Equipment

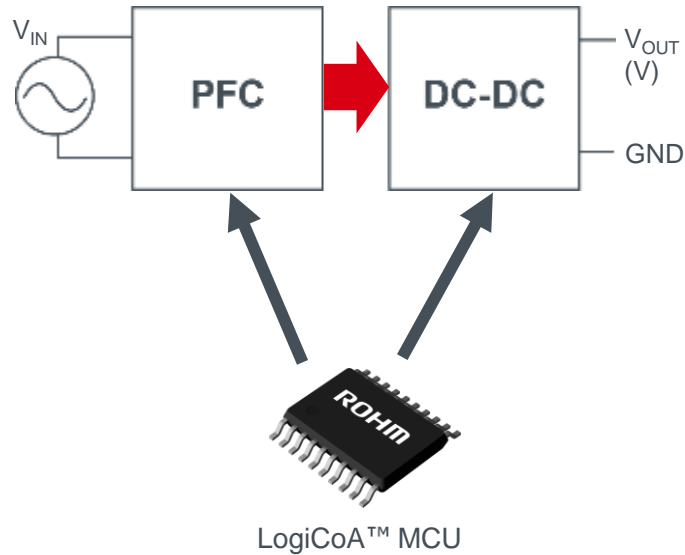
Analyzing log data collected from the LogiCoA™ MCU by a control PC makes it possible to monitor the operational status of both the application and power supply unit itself

The LogiCoA™ MCU and RMOS Simultaneously Control Two Topologies

Examples of simultaneous control of two topologies

Example 1

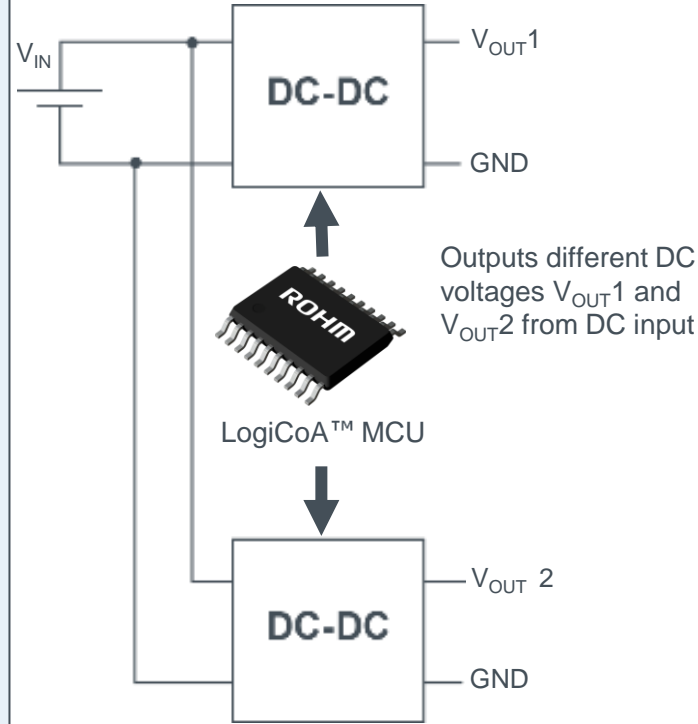
Simultaneous Control of PFC and DC-DC



Outputs a DC voltage V_{OUT} from AC input

Example 2

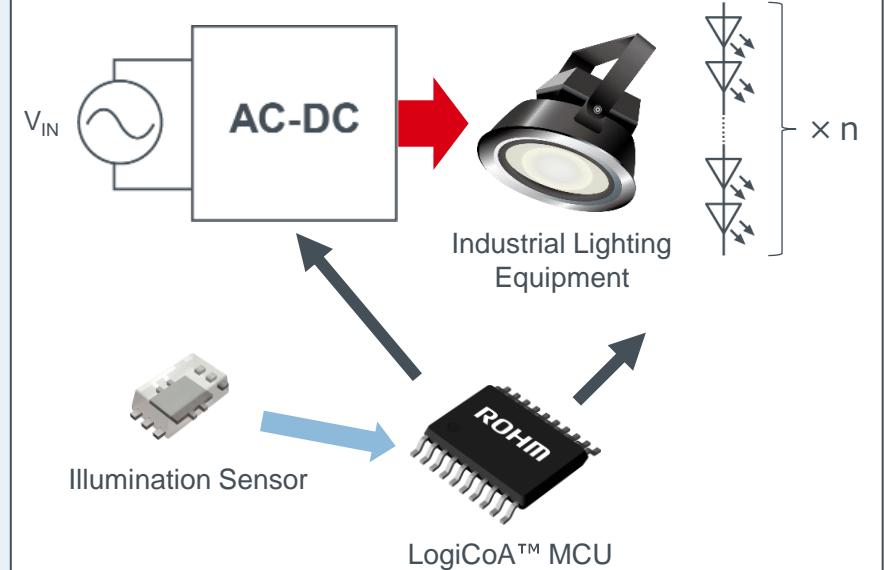
Simultaneous Control of 2 DC-DC Systems



Outputs different DC voltages V_{OUT1} and V_{OUT2} from DC input

Example 3

Control the Brightness and Dimming of LED Lighting from an AC Power Source



Controls AC-DC conversion for driving LEDs from an AC power source while simultaneously outputting a PWM signal for dimming control

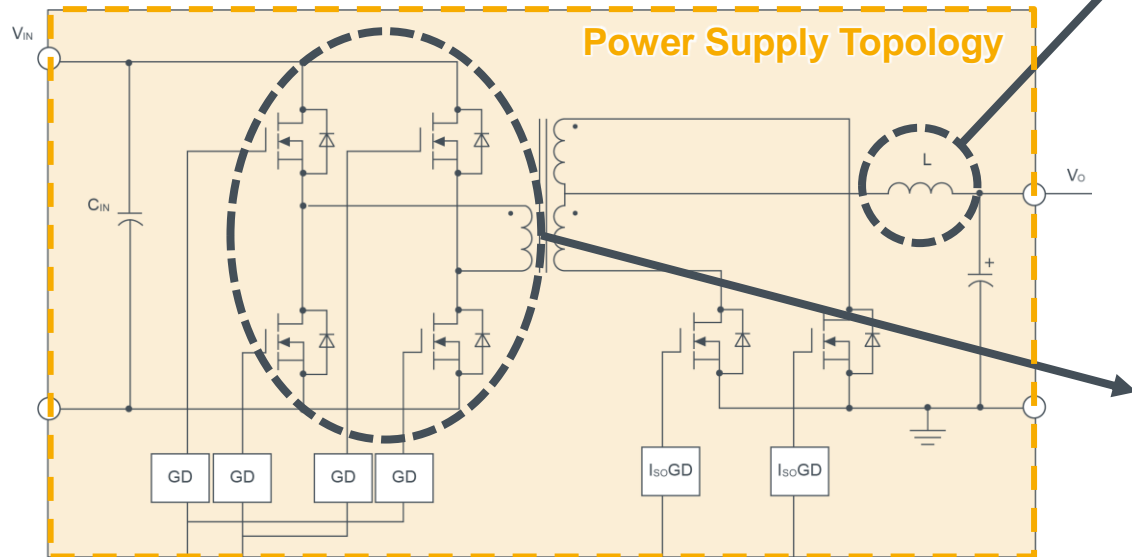
By combining Examples 1 and 2, it is possible to control the output of three different DC voltages from an AC power source using just two LogiCoA™ MCUs

The current of the serial LED array is PWM controlled according to ambient conditions to adjust the LED brightness

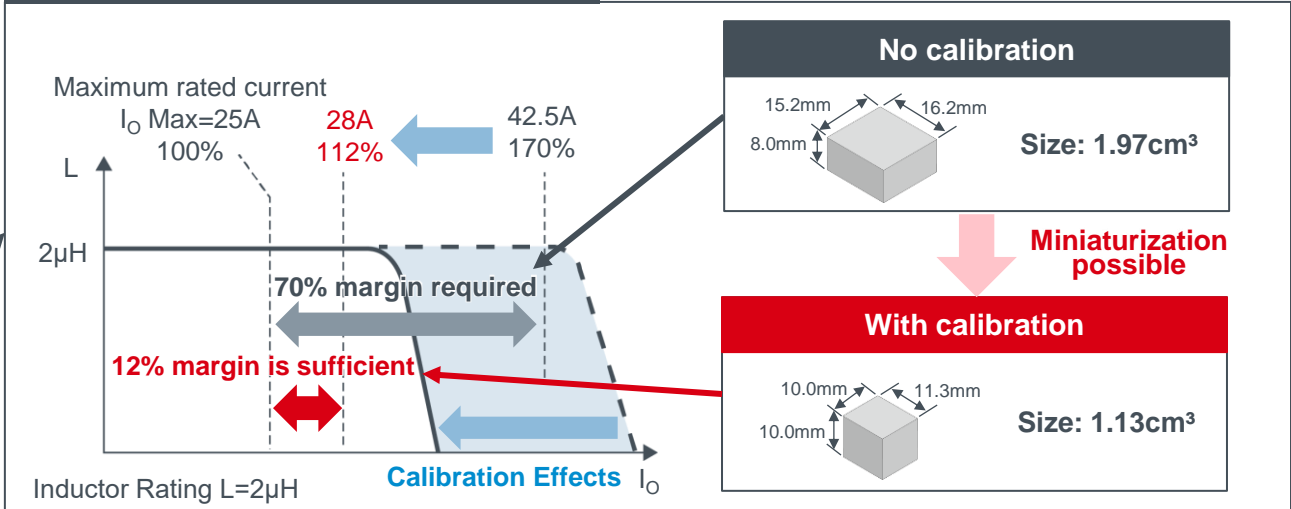
Built-in Calibration Function Improves Component Characteristics

The calibration function:

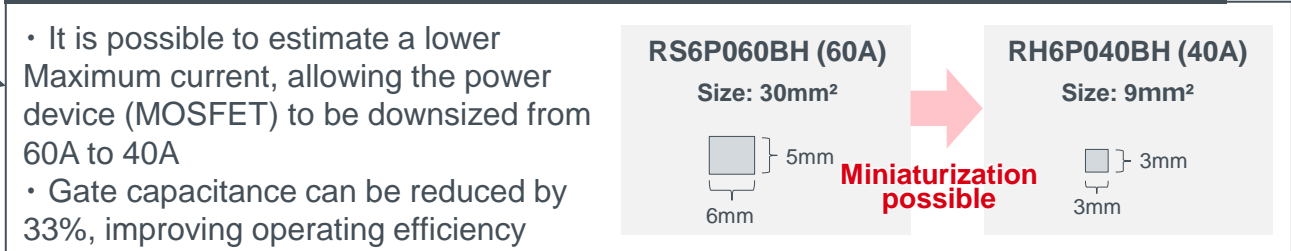
Stores calibration data in the MCU to compensate for variations in individual circuits and mounted parts at the time of shipment, ensuring that various protection functions operate at appropriate values



Example 1: Minimizes inductor size



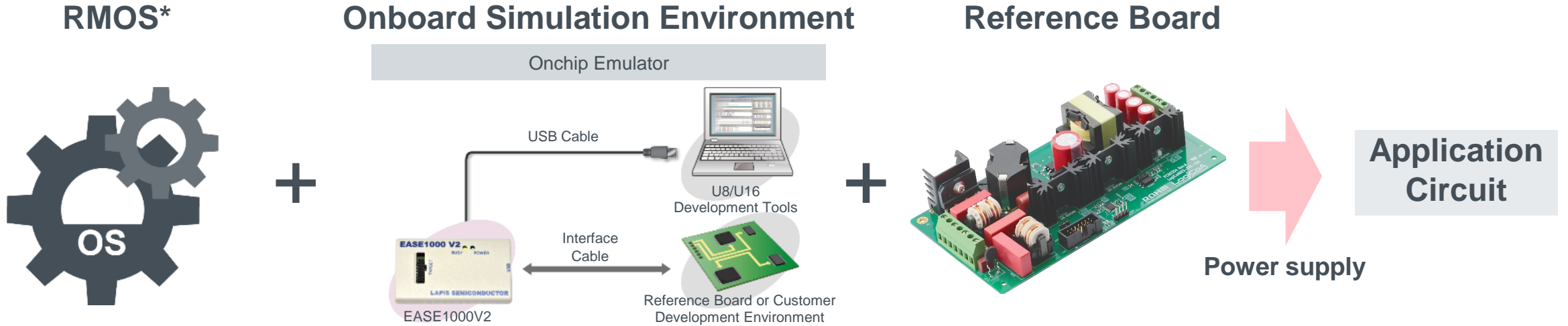
Example 2: Reduces power device size while improving operational efficiency



In power supplies equipped with LogiCoA™, a calibration function is included to improve performance while supporting smaller components

Reference Boards and RMOS Available for Easy Implementation

ROHM offers RMOS* and a software development environment along with reference boards



ROHM Website: <https://www.rohm.com/lapis-tech/product/micon/software>

Integrating two power processing functions along with communication and background processing capabilities (i.e. log acquisition) facilitate program development

The extensive software development environment allows for onboard program debugging

Connecting application circuits make it possible to optimize the power supply design under actual operating conditions

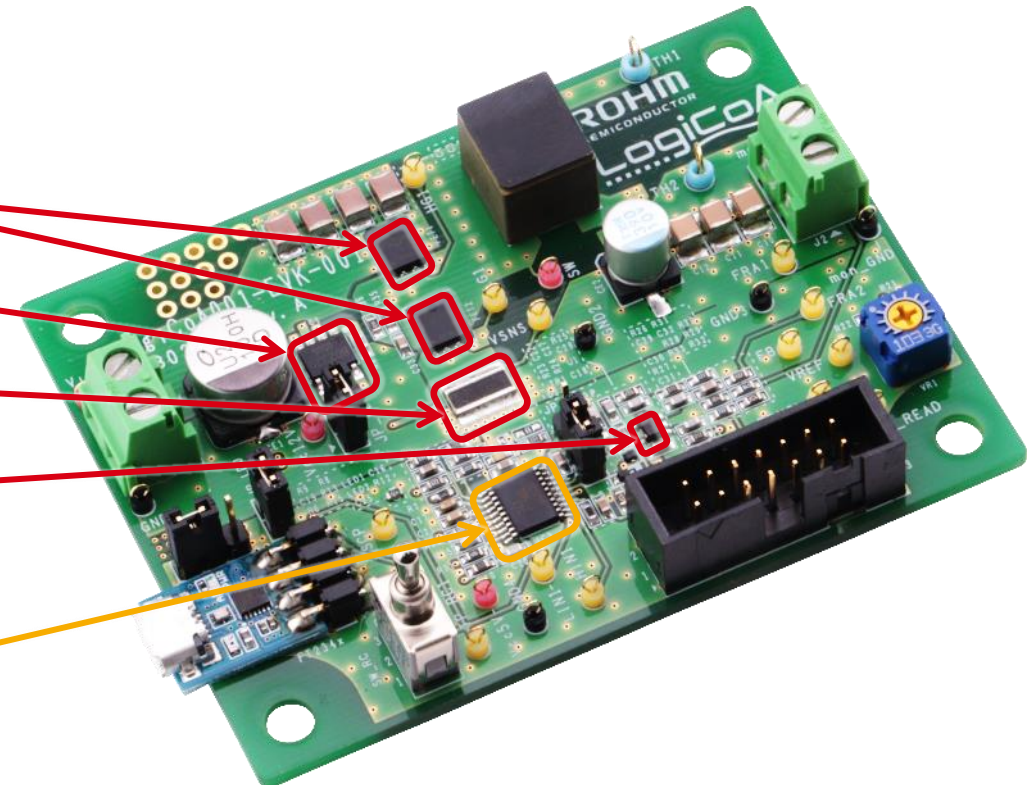
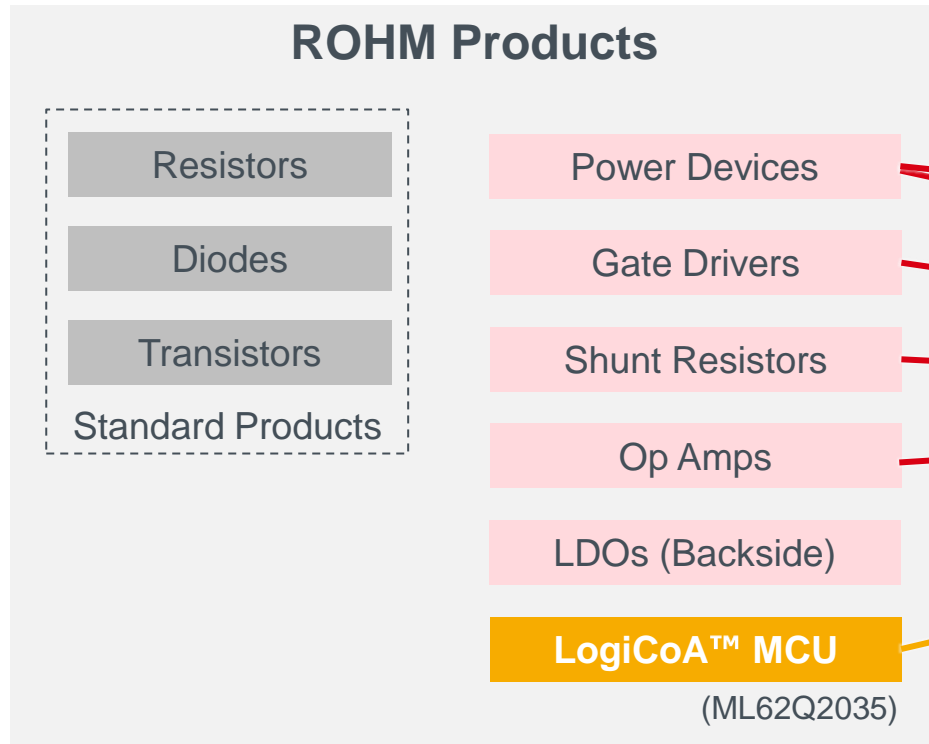
Providing reference boards and RMOS* optimized for specific power supply topologies allows users to design power supplies that meet application requirements

Onchip emulator: A general term for environments that enable onboard software development

*RMOS (Real-time Micro Operating System)

LogiCoA™ Reference Board Example

- Function: Non-isolated Buck DC-DC Converter
- Specifications: Input Voltage=12V, Output Voltage/Current=5V/5A

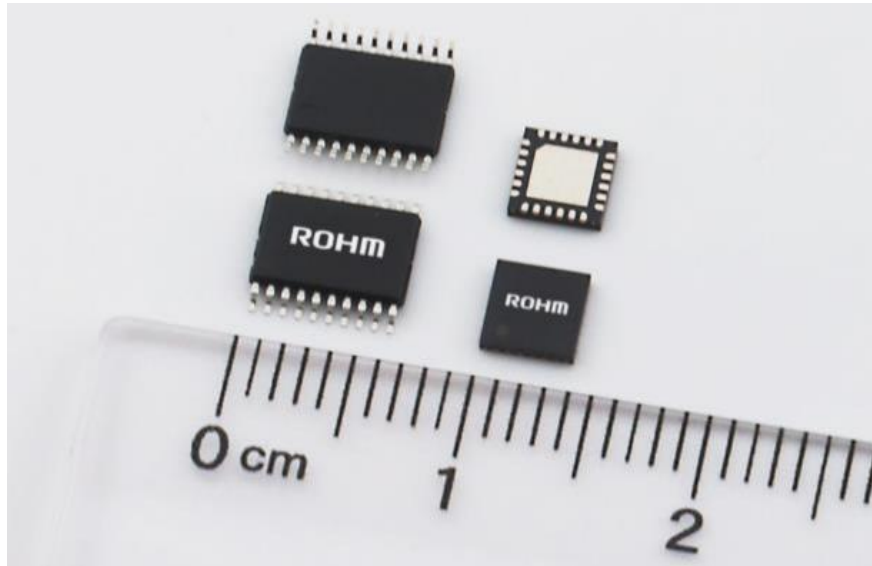


LogiCoA™ solutions not only include a core LogiCoA™ MCU, but other ROHM components as well that will vary depending on the power supply topology

LogiCoA™ MCUs

Part No.	Op. Voltage	Temperature	Timer		Comparator	A/D Conv.	D/A Conv.	Programmable Gain Amp	CPU	Memory			Package
										Code Flash	Data Flash	RAM	
ML62Q2033	4.5V to 5.5V	Ta= -40°C to +105°C (Tj= +115°C) (Absolute Maximum Rating: Tj Max= +125°C)	16bit timer with PWM/Capture × 6 counters, 64MHz (Max) operation (15.625ns resolution)	10 outputs	3ch (asynchronous clock operation)	12bit SA-ADC: 5ch	8bit, 2ch	1ch, Gain setting: 4-level (×4/×8/×16/×32)	16bit RISC CPU Core (U16), 16MHz (Max) operation	16KB	4KB (Minimum erasable unit: 128B)	2KB	TSSOP20
ML62Q2035										32KB			
ML62Q2043				16KB	WQFN24								
ML62Q2045				32KB									

ROHM Website <https://www.rohm.com/products/micon/logicoa>



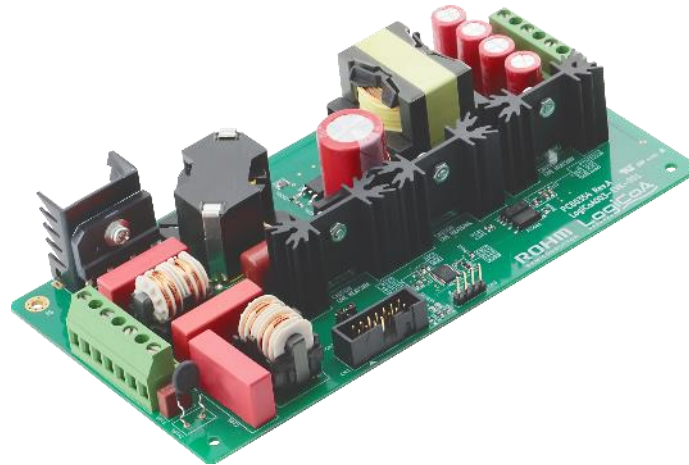
Mass production of LogiCoA™ MCUs (the core components of LogiCoA™ power solutions) began in June 2024

Non-isolated Buck DC-DC Converter
[Available since April 2024]



Reference Design Examples
<https://www.rohm.com/reference-designs/ref66009>

PFC + DC-DC Converter
[Planned for the 1st quarter of FY2025]



Full-Bridge Converter
[Planned for the 1st quarter of FY2025]



Reference design boards will be offered in a variety of power supply topologies

Notes

- The information contained in this document is intended to introduce ROHM Group (hereafter referred to as ROHM) products. When using ROHM products, please verify the latest specifications or datasheets before use.
- ROHM does not warrant that the information contained herein is error-free. ROHM shall not be in any way responsible or liable for any damages, expenses, or losses incurred by you or third parties resulting from errors contained in this document.
- The information and data described in this document, including typical application circuits, are examples only and are not intended to guarantee to be free from infringement of third parties intellectual property or other rights. ROHM does not grant any license, express or implied, to implement, use, or exploit any intellectual property or other rights owned or controlled by ROHM or any third parties with respect to the information and data contained herein.
- When exporting ROHM products or technologies described in this document to other countries, you must abide by the procedures and provisions stipulated in all applicable export laws and regulations, such as the Foreign Exchange and Foreign Trade Act and the US Export Administration Regulations, and follow the necessary procedures in accordance with these provisions.
- No part of this document may be reprinted or reproduced in any form by any means without the prior written consent of ROHM.
- The information contained in this document is current as of July 2024 and is subject to change without notice.



ROHM Co.,Ltd.

21 Saiin Mizosaki-cho, Ukyo-ku,
Kyoto 615-8585 Japan

www.rohm.com