



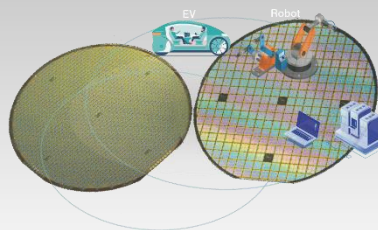
Solving Power Supply Issues with ROHM's Nano Series of Leading Edge Power Supply Technologies

ROHM Co., Ltd.



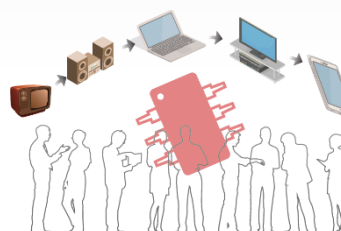
Power Technology

Contributing to the creation of new value and solving social issues through the development of innovative power devices

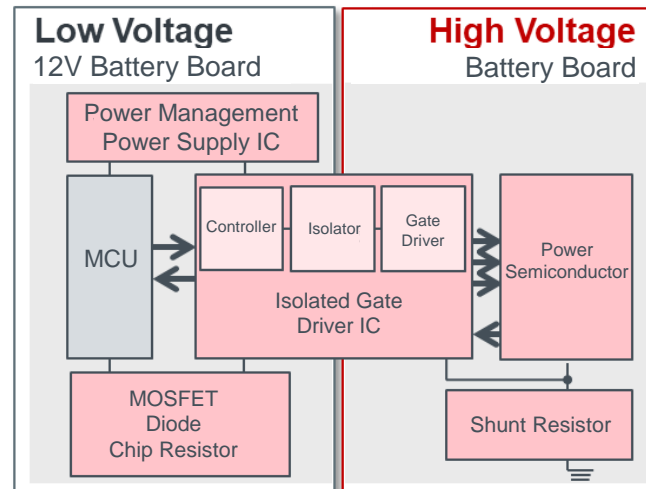


Analog Technology

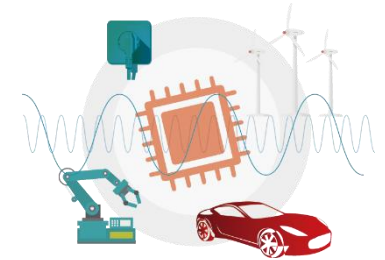
Contributing to meeting system needs by continuing to refine advanced analog technologies



Sample Power Solution



Analog technology cultivated over many years results in more intelligent devices that consume less power



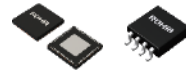
Maximizing the performance of power semiconductors

Driver ICs



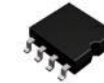
Intelligent power-saving drive

**Power Management
Power Supply ICs**

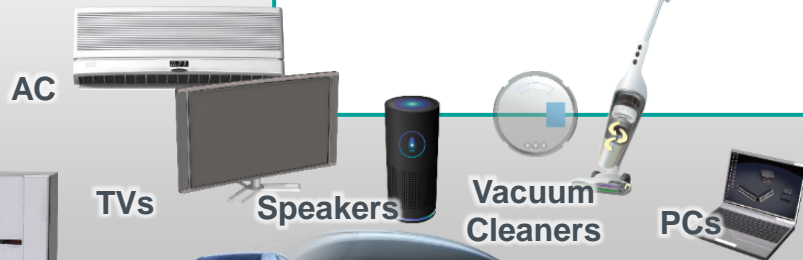


Unprecedented noise immunity solves noise issues

**Op Amps /
Comparators**



Nano Power Supply Technologies



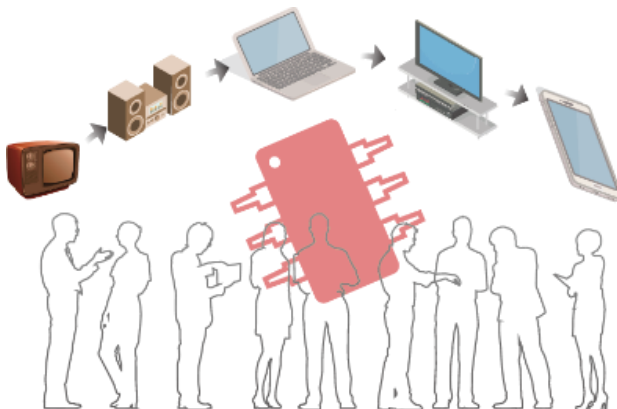
**Promoting elemental
Nano technologies in a
variety of applications**



Refrigerators Automotive Mobile Devices

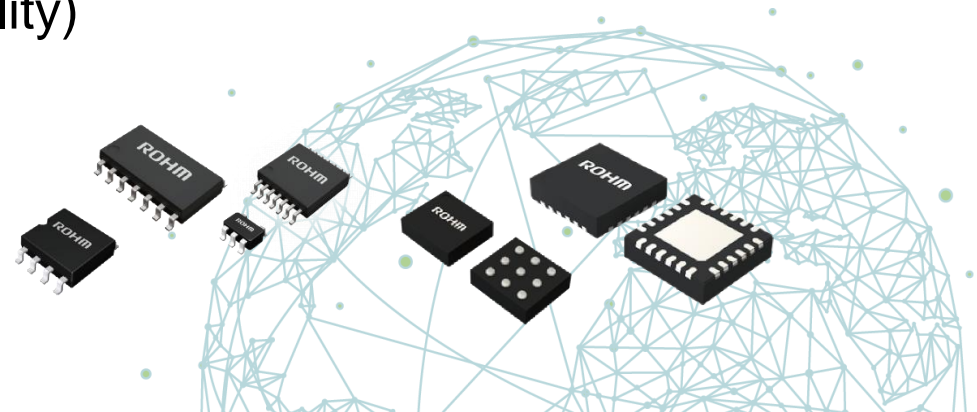
Solutions that Applications Require

- Power saving (longer application life)
- High power compatibility
- Increased functionality (including greater miniaturization)
- Safety functions



Solutions that Power Supply ICs Can Provide

- High power conversion efficiency, low current consumption
- Higher withstand voltage, large current support
- High integration, fewer peripheral components/greater miniaturization
- Protection functions, long-term operation (high reliability)



What is Nano Power Supply Technology?

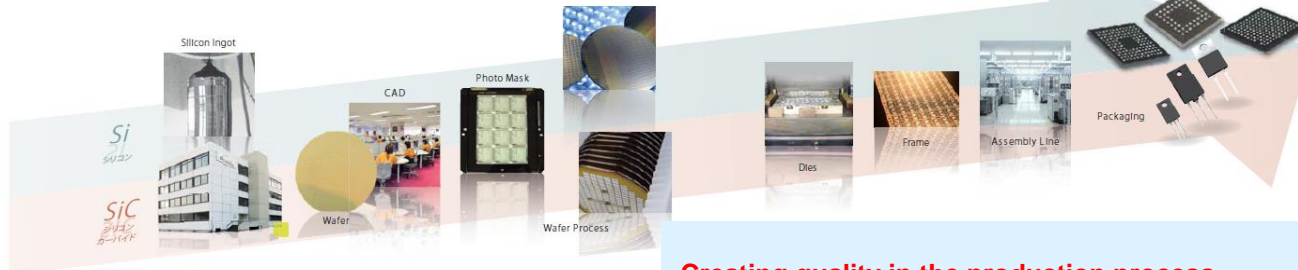


Nano power supply technologies were developed by combining advanced analog expertise covering circuit design, processes, and layout utilizing ROHM's vertically integrated production system

Creating quality in the development process

Circuit Design: Element characteristics, power fluctuations, signal level, etc.

Layout: Circuit layout, pairing, signal interference, etc.



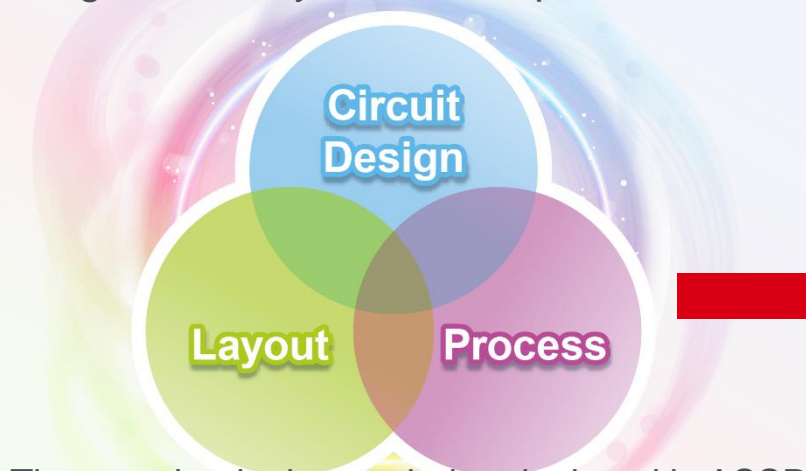
A Vertically Integrated Production System

Creating quality in the production process

Wafer: Element shape, element materials, wiring materials, etc.

Package: Heat dissipation characteristics, frame materials, wiring materials, etc.

Combining 3 analog technologies to achieve high efficiency and stable power control



These technologies are being deployed in ASSPs
(Application Specific Standard Products)

3 technologies solve current market needs of power supply systems

**Higher voltages and
frequencies**



Enables direct step-down from 60V to 2.5V

ns

**Ultra-high-speed pulse control
technology**

Nano Pulse Control™



**Lower current
consumption**



Enables 10-year drive on a single coin battery

nA

**Ultra-low current consumption
technology**

Nano Energy™



**Fewer external parts •
Greater miniaturization**



Achieves industry-leading voltage fluctuation
regardless of capacitance

nF

Ultra-stable control technology

Nano Cap™



Expanding 48V Systems: The Need for Higher Withstand Voltages and Higher Frequency Operation

48V System Requirements

Current



Wide range of 48V applications in the industrial equipment sector

Future



12VDC HEVs
(Li, Pb)

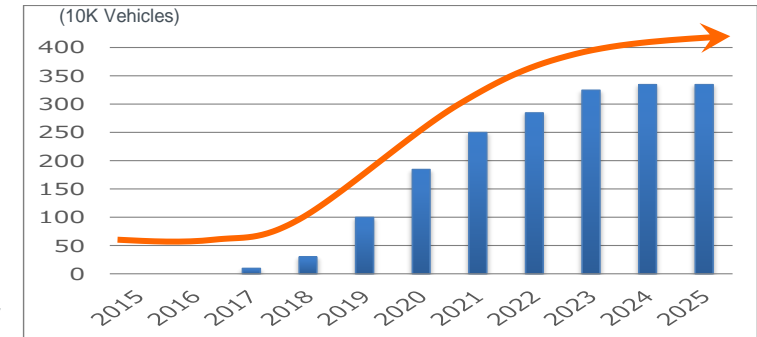
Switching to 48V vehicle power supplies

Target

Power supplies for 48V battery systems in mild hybrid EVs

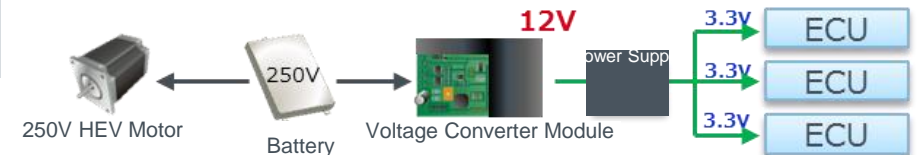
- ✓ European manufacturers are leading the development to achieve CO2 reduction targets
- ✓ The motors and batteries are smaller than conventional HEV systems, improving cruising range

Market Trend for 48V Mild Hybrid Vehicles

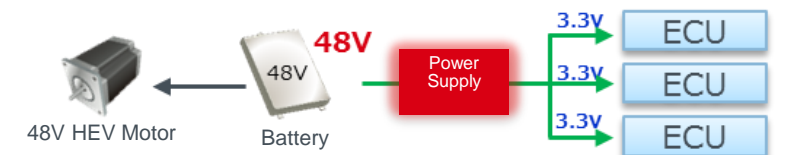


What is a 48V Hybrid System?

Conventional HEV System



48V Mild Hybrid System

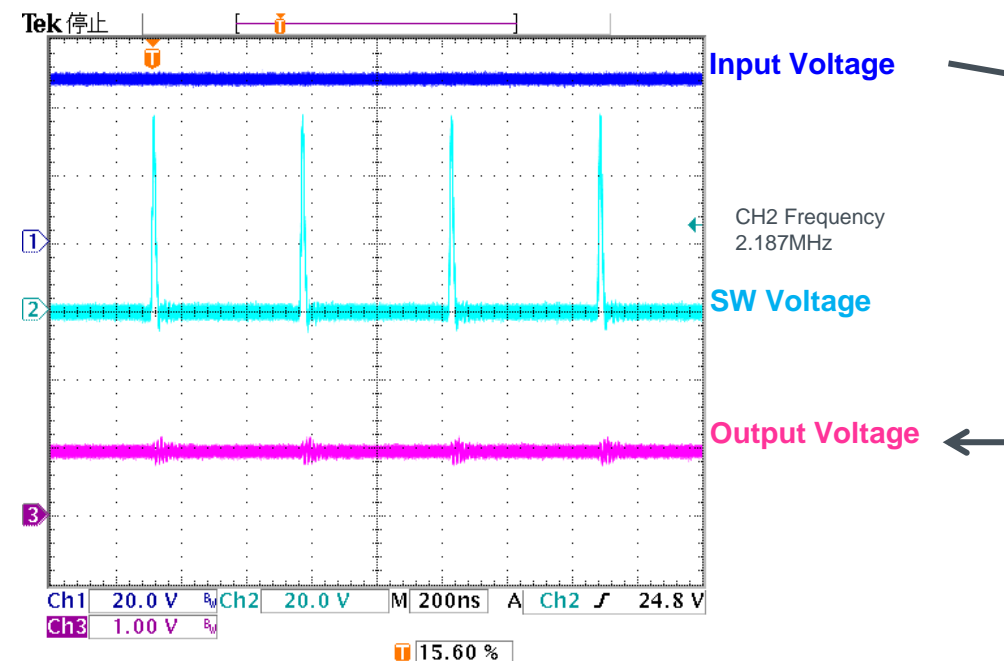
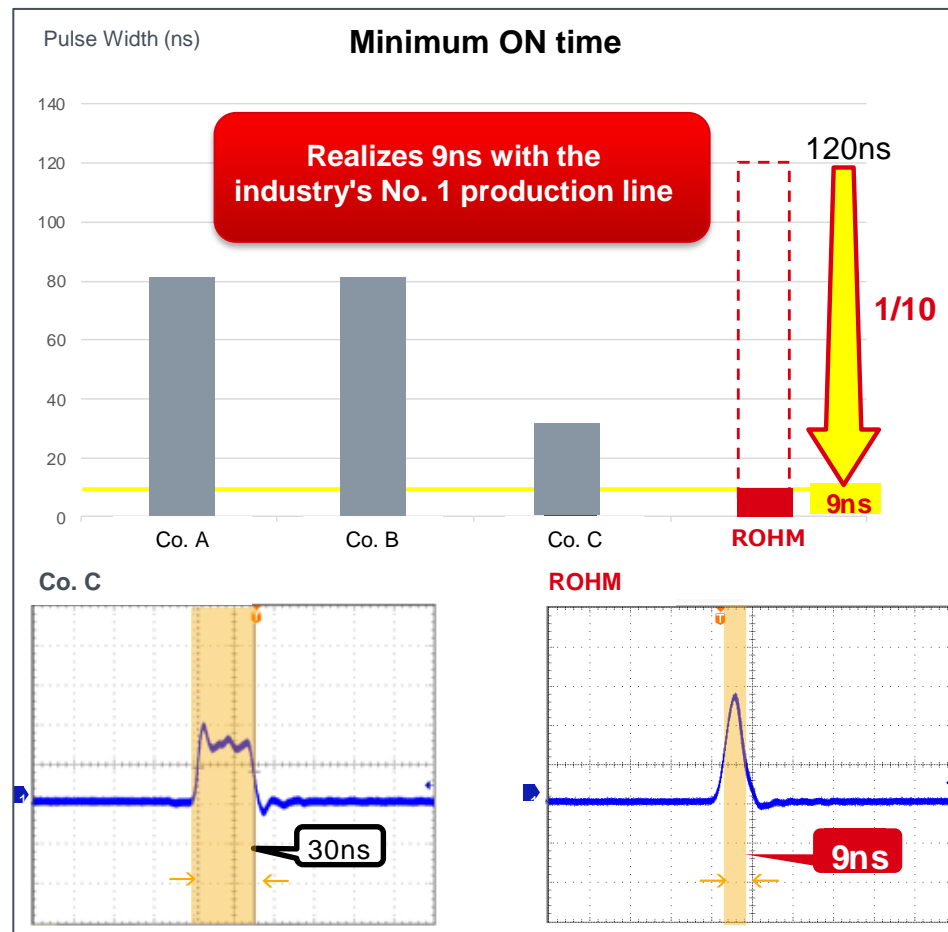


Power supply ICs are required to output a low output voltage from a high input voltage

Proprietary method enables stable voltage control even with extremely short switching ON time (which has been difficult to achieve in the past)

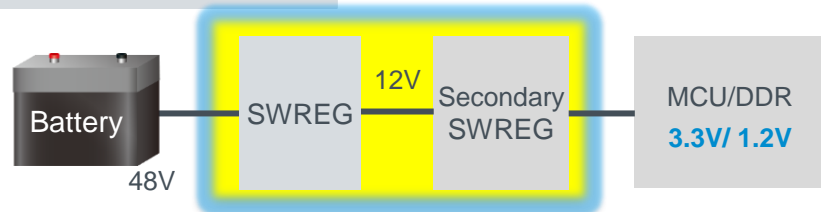
*ROHM Sept. 2017 study

Achieves the world's smallest* ON time of 9ns

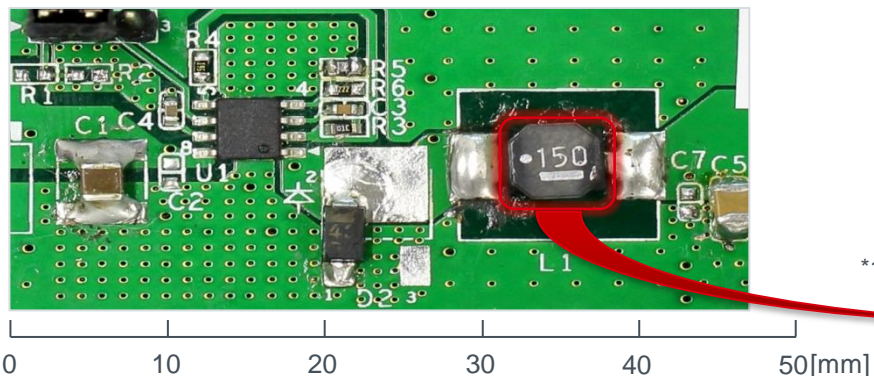


➔ For example, 1V can be directly output from 48V input (f=2MHz)

Existing Configuration



Cannot output 1.2V or 3.3V from 48V input (f=2MHz)
Requires a secondary SW regulator

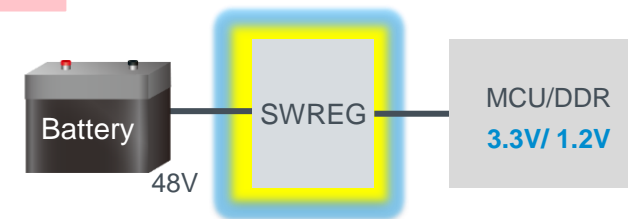


Solution size: 47mm x 25mm
1175mm²

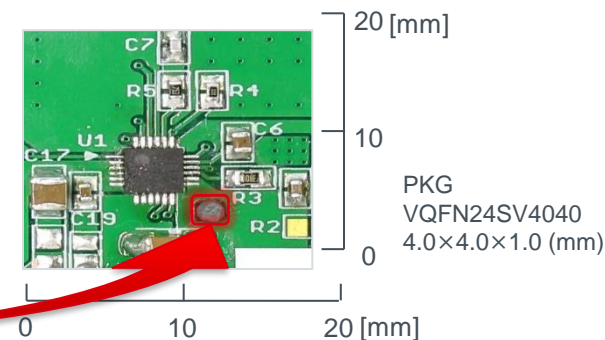
1 Chip



New Structure



1.2V and 3.3V output possible from 48V input (f=2MHz)
Secondary SW regulator not needed



Inductor size*1
6mm² ⇒ 2.4mm²

*1: NRS6028T(15uH) idc=1.6A
NRH2412T(2.2uH) idc=1.7A

Reduced 70%

Solution size: 18mm x 20mm
360mm²

➡ Single-chip solution contributes to greater space savings

Key Point

Power supply ICs featuring even lower current consumption

Wearable Market

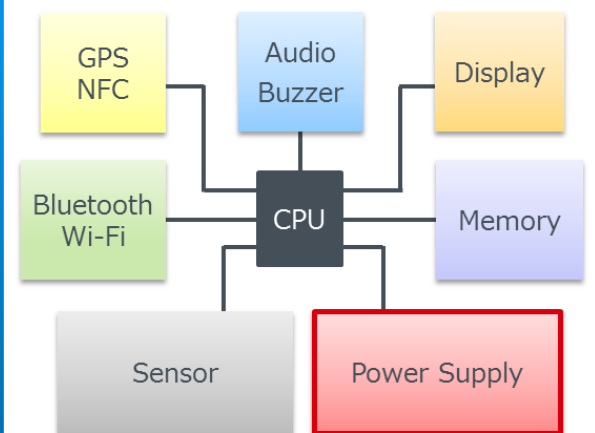


Requires a low consumption power supply IC

Development Trends

- Improved safety
- Greater miniaturization
- Longer life

Wearable Device



Automotive Market

Clock

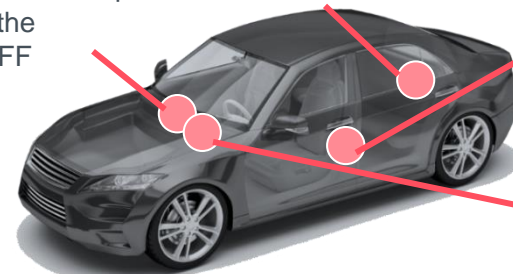
Backup operation even when the display is OFF

Alarm System

Functions that operate when parked

Keyless

Functions that operate when parked



Car Navigation

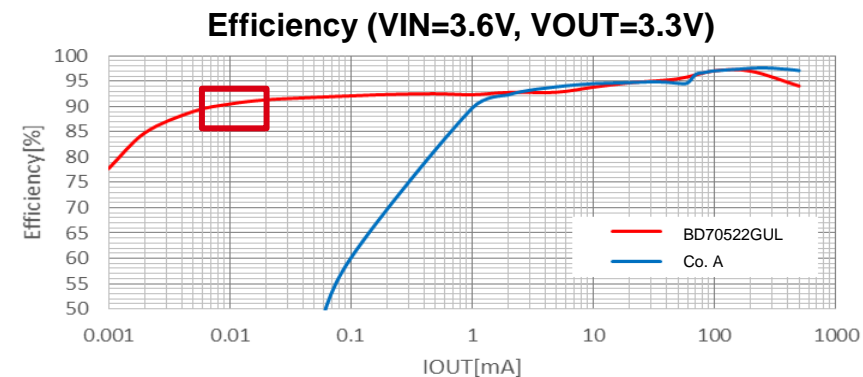
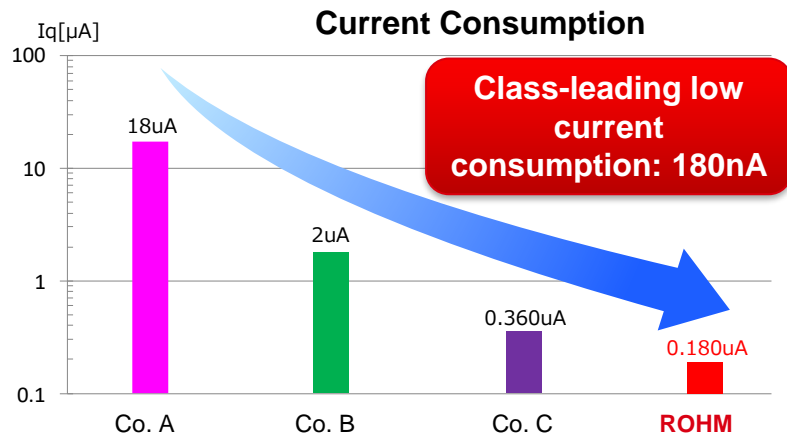
Memory backup requires a power supply

Development Trends

- Proliferation of EVs/HEVs
Low power consumption is required to improve fuel economy
- Idle stop
Stops the engine when the vehicle stops, with the battery providing the necessary power
- Increasing number of functions that operate when parked
Power supplied by battery may cause battery drain

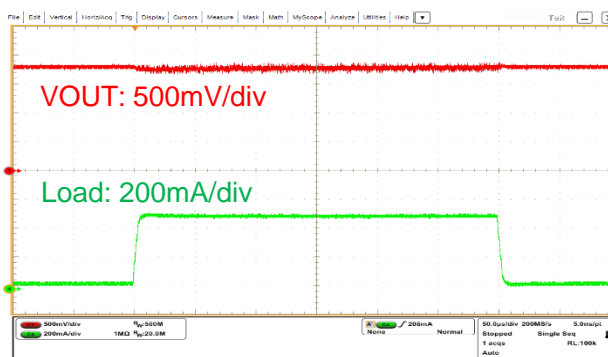
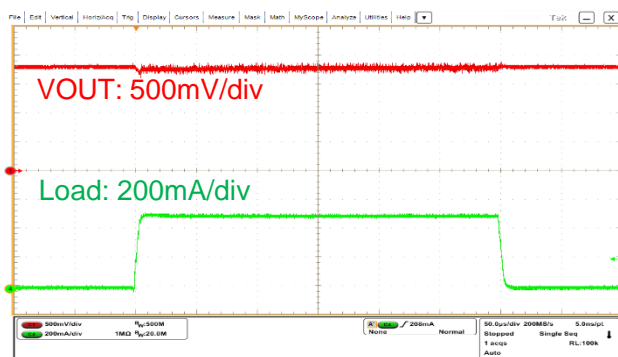
Features of the BD70522GUL with Nano Energy™

Achieves ultra-low 180nA current consumption



Achieves a max. efficiency of 90% at 10uA load current
→ Significantly reduces standby loss

Load Fluctuation (VIN=3.6V, VOUT=3.3V)



Achieves fast response to load fluctuations at ultra-light loads

Ensures even faster response at light loads

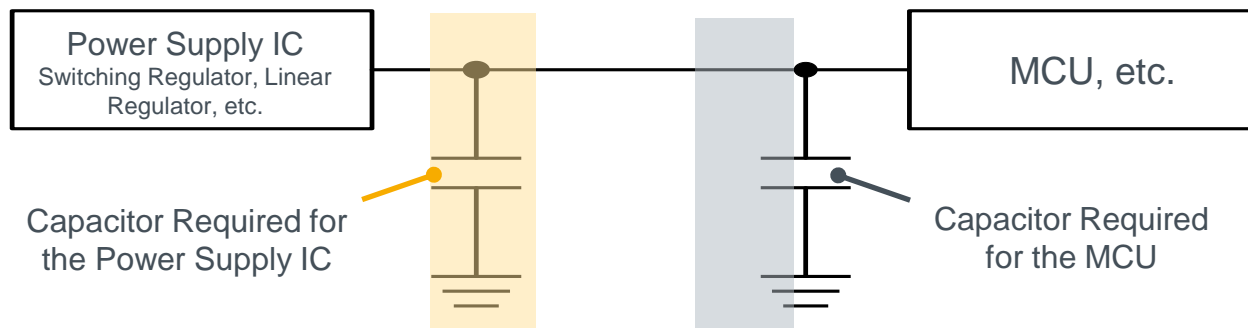
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Solutions that Power Supply ICs Can Provide

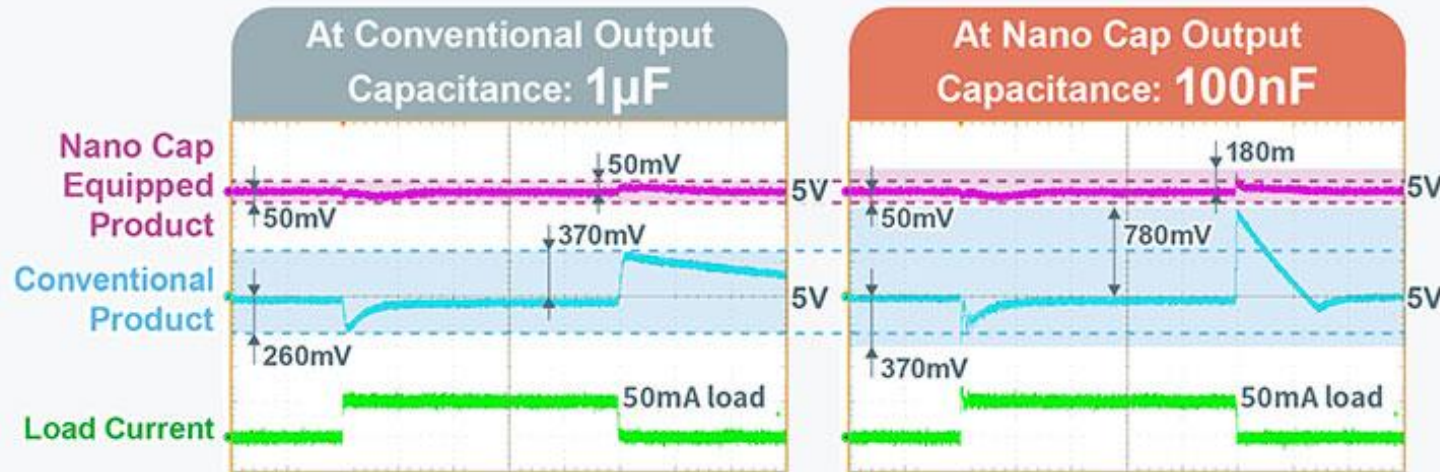
- High power conversion efficiency, low current consumption
- Higher withstand voltage, large current support
- High integration, fewer peripheral components/greater miniaturization
- Protection functions, long-term operation (high reliability)

Relationship Between the Power Supply IC and System (i.e. MCU)



Power supply ICs need to be able to simply reduce the number of capacitors

Nano Cap™ Achieves Ultra-Stable Control



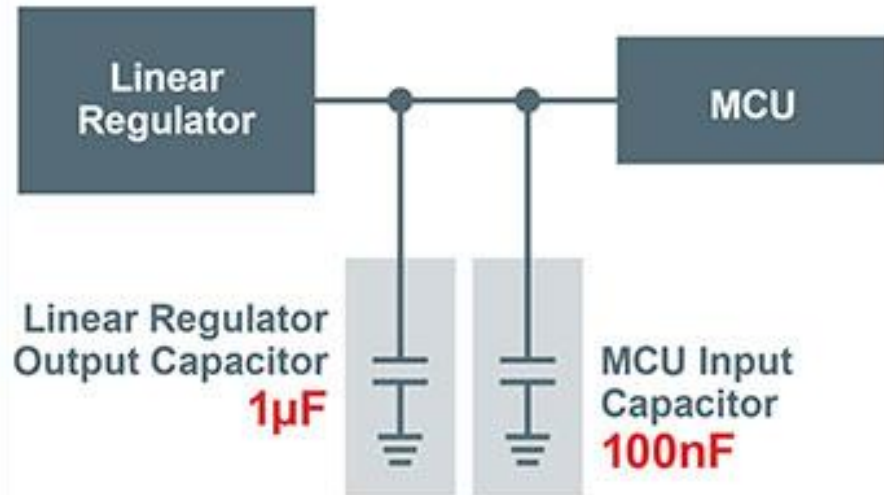
	At Conventional Output Capacitance: 1µF	At Nano Cap Output Capacitance: 100nF
Max. Voltage Fluctuation		
Nano Cap Equipped Product	±1.0% at 1µF	±3.6% at 100nF
(100nF Compatible) Conventional Product	±7.4% at 1µF	±15.6% at 100nF

Conditions 5V output voltage, 50mA load current fluctuation

➡ Achieves ultra-stable operation with a voltage fluctuation of $\pm 5\%$ even with 1/10th the capacitance

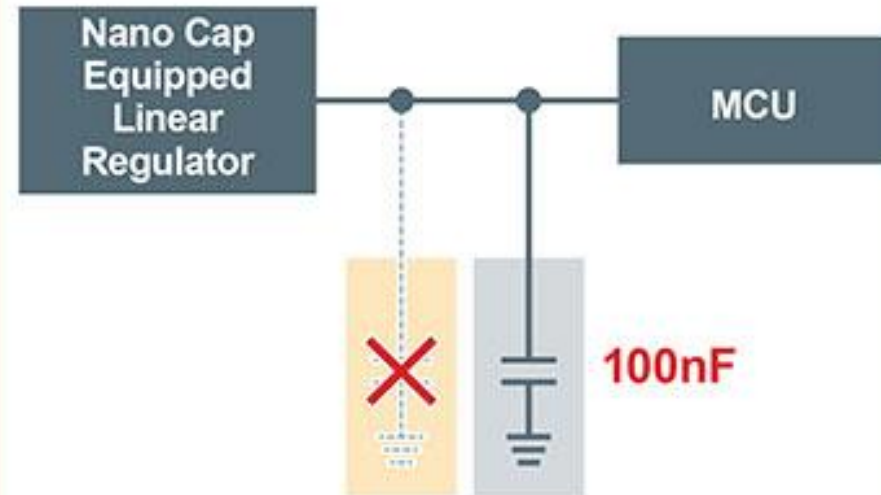
Nano Cap™ Solution

Conventional Capacitor Configuration



One capacitor is required each for the linear regulator and MCU

Nano Cap Capacitor Configuration



Ensures stable operation even without a linear regulator output capacitor

➡ **Eliminating the output capacitor solves capacitance issues in a variety of applications**

Latest Power Supply IC Technologies

"ROHM Nano"



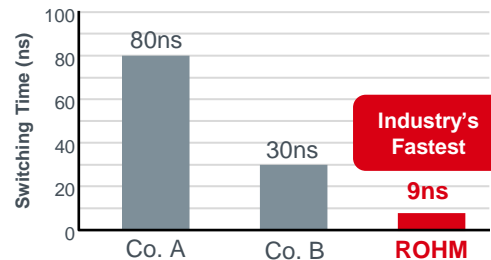
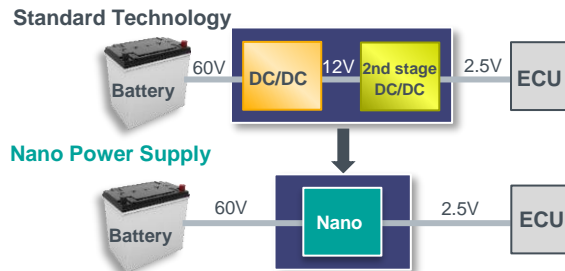
Nano Pulse Control™



Enables direct step-down from 60V to 2.5V

ns

Ultra-high-speed pulse control technology



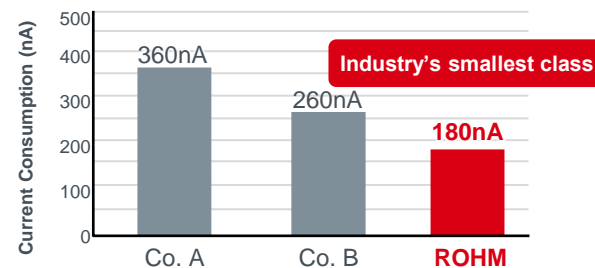
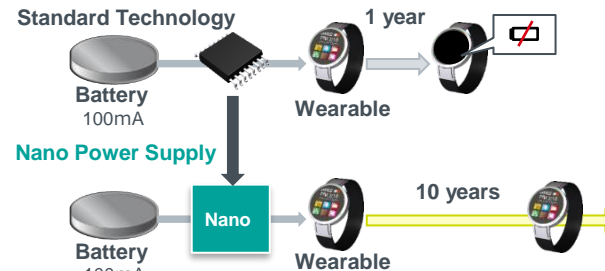
Nano Energy™



Provides 10-year drive on a single coin battery

nA

Ultra-low current consumption technology



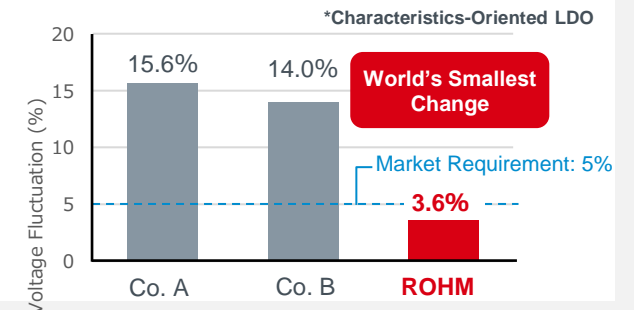
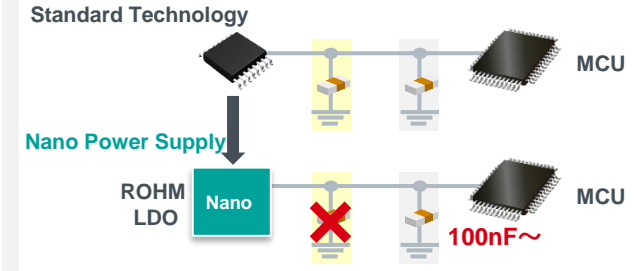
Nano Cap™



Achieves industry-leading voltage fluctuation regardless of capacitance

nF

Ultra-stable control technology





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- If you wish to use any such Product, please be sure to refer to the specifications, which can be obtained from ROHM upon request.
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