



Electronics for the Future



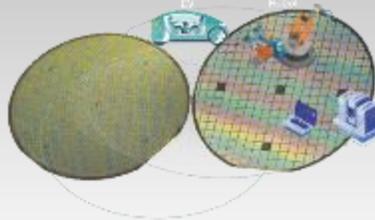
Solving Power Supply Issues with ROHM's Nano Series of Leading-Edge Power Supply Technologies

ROHM Co., Ltd.



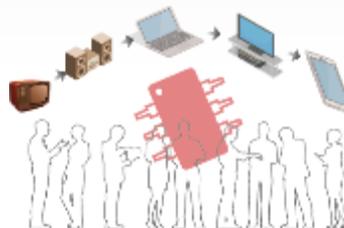
Power Technology

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

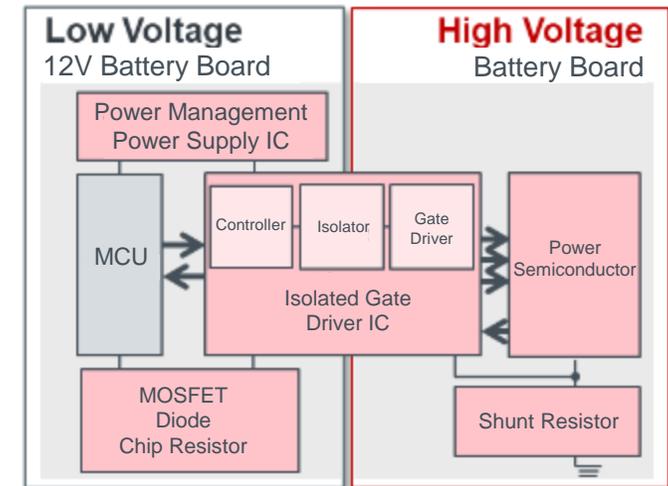


Analog Technology

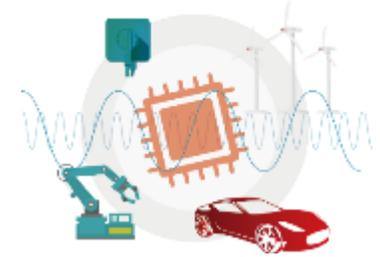
Contributing to meeting system needs by continuing to refine advanced analog technologies



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

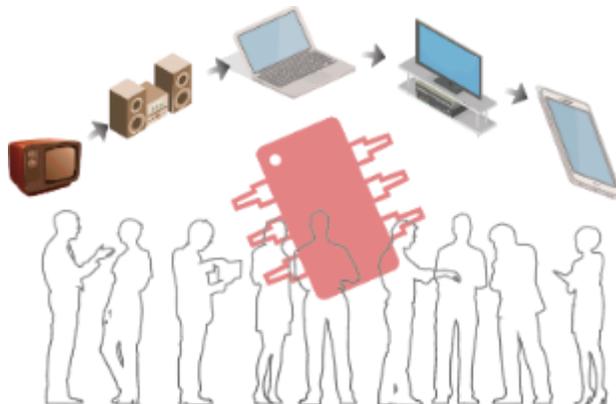


**Promoting elemental
Nano technologies in a
variety of applications**



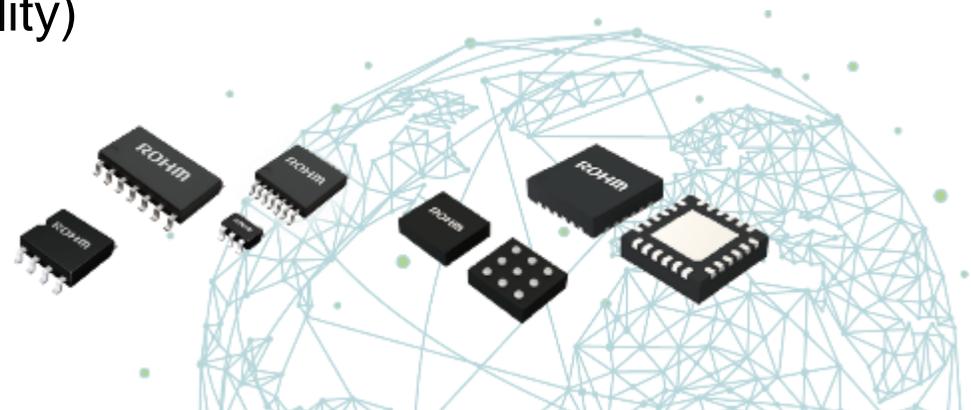
Solutions that Applications Require

- 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?



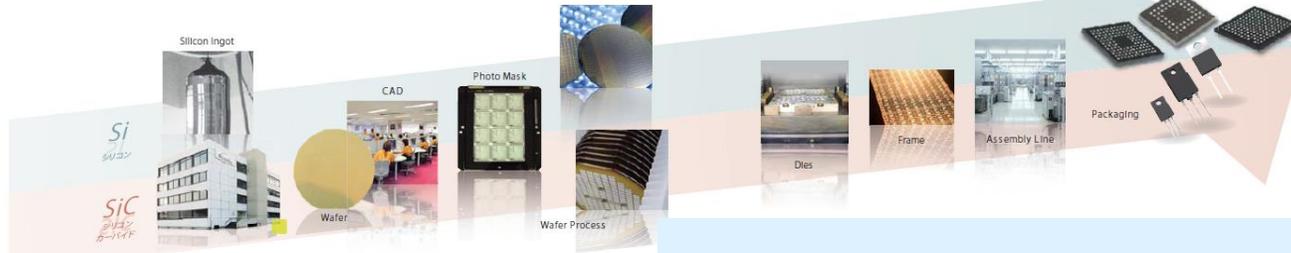
Nano power supply technologies were developed by combining advanced analog expertise covering circuit design, processes, and layout utilizing ROHM's vertically integrated production system

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

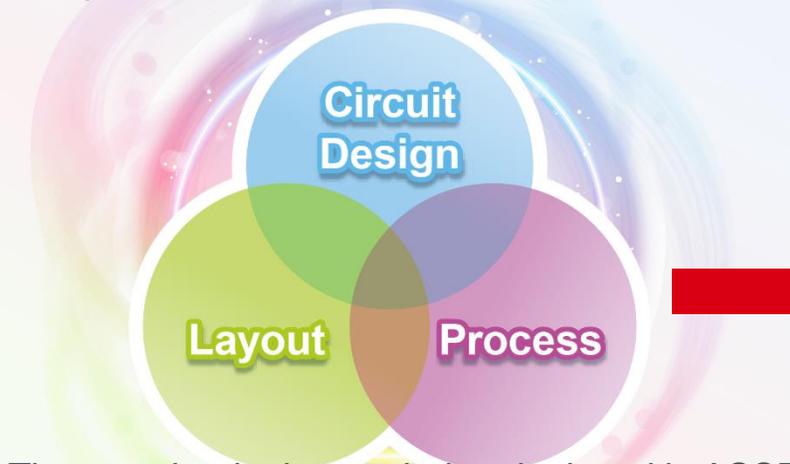


Creating quality in the production process

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™



Greater miniaturization •
Reduced design load



Eliminates stability issues related to capacitance

nF

Ultra-stable control technology

Nano Cap™



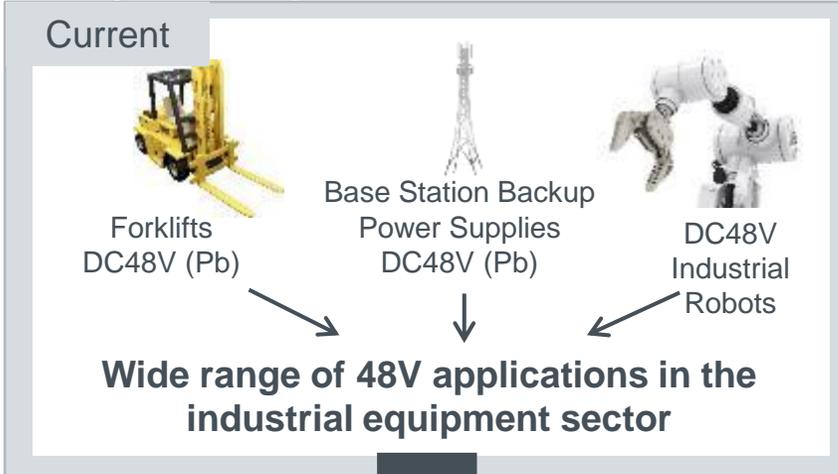
*Nano Pulse Control™, Nano Cap™, and Nano Energy™ are trademarks or registered trademarks of ROHM Co., Ltd.



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



48V System Requirements

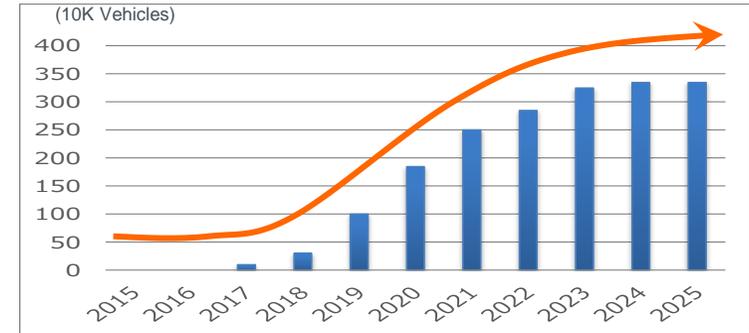


Target

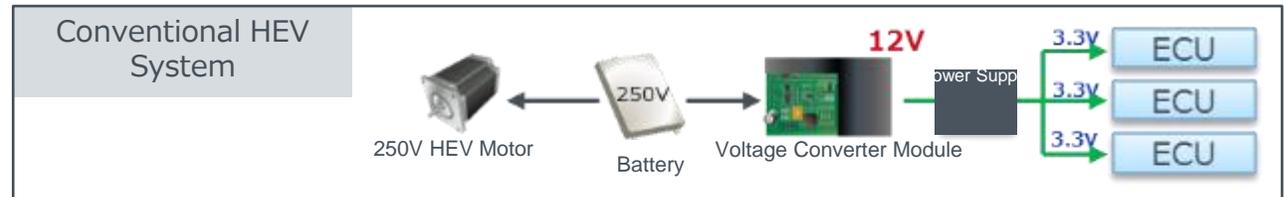
Power supplies for 48V battery systems in mild hybrid EVs

- ✓ 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?

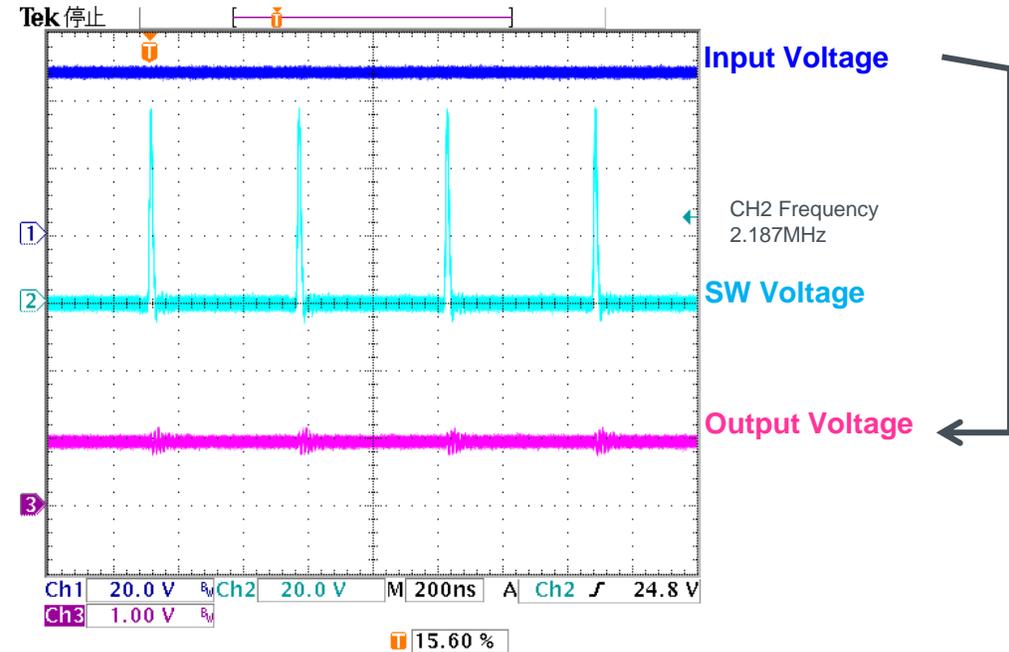
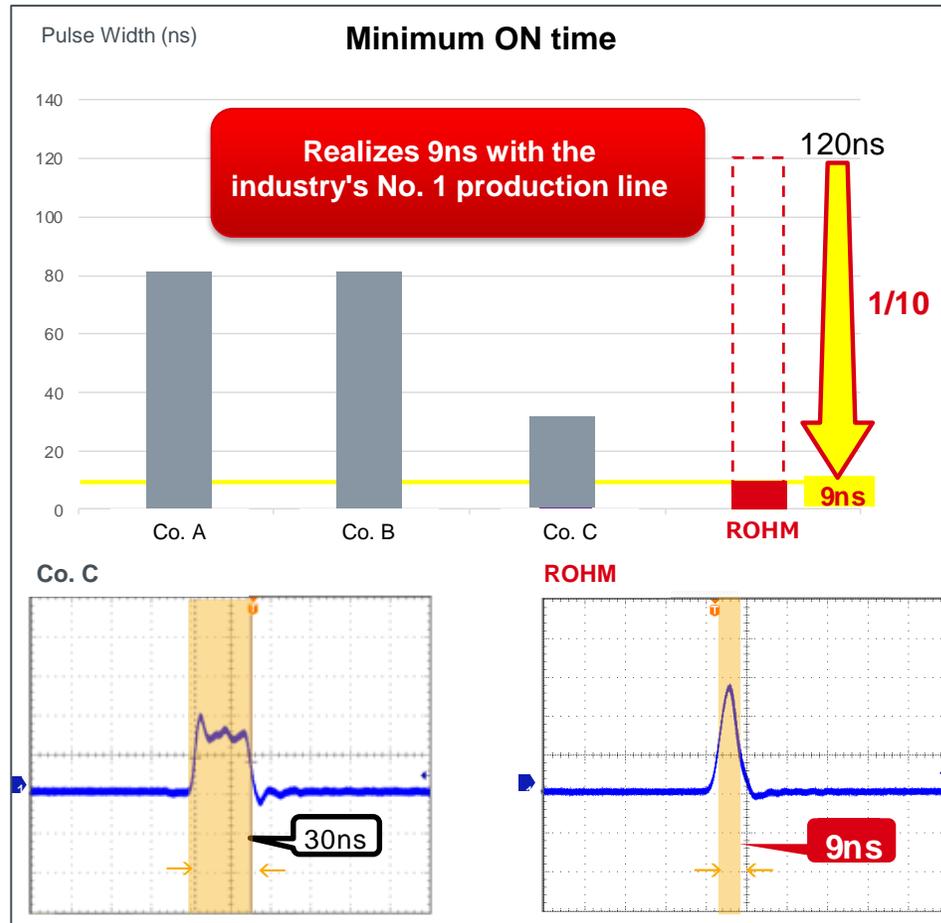


Power supply ICs are required to output a low output voltage from a high input voltage

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

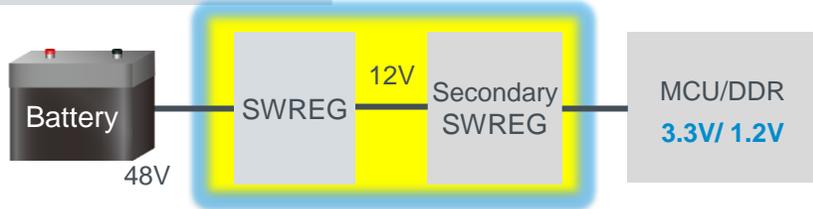
*ROHM Sept. 2017 study

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

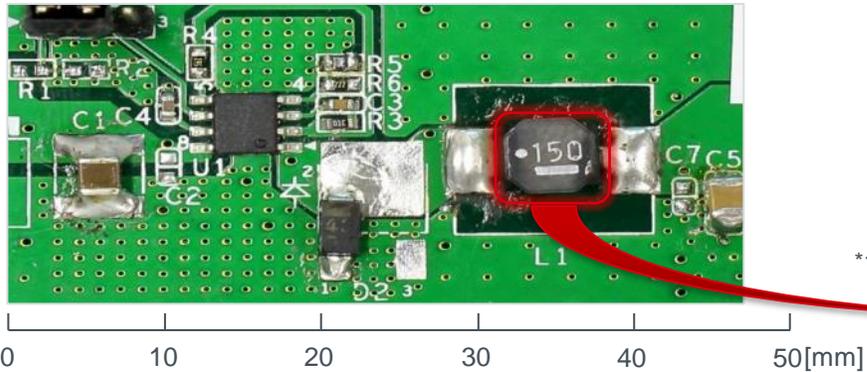


➔ For example, 1V can be directly output from 48V input (f=2MHz)

Existing Configuration

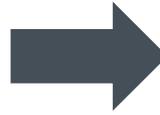


Cannot output 1.2V or 3.3V from 48V input (f=2MHz)
Requires a secondary SW regulator

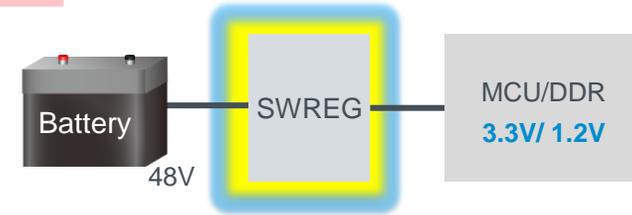


Solution size: 47mm x 25mm
1175mm²

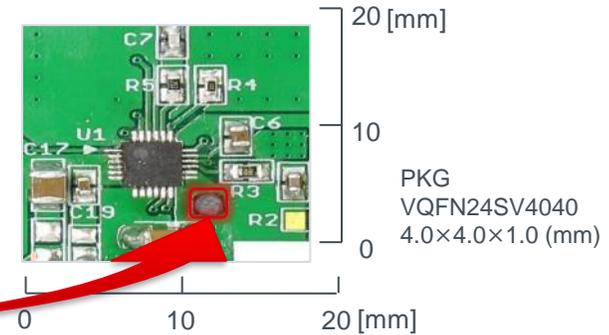
1 Chip



New Structure



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



PKG
VQFN24SV4040
4.0×4.0×1.0 (mm)

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

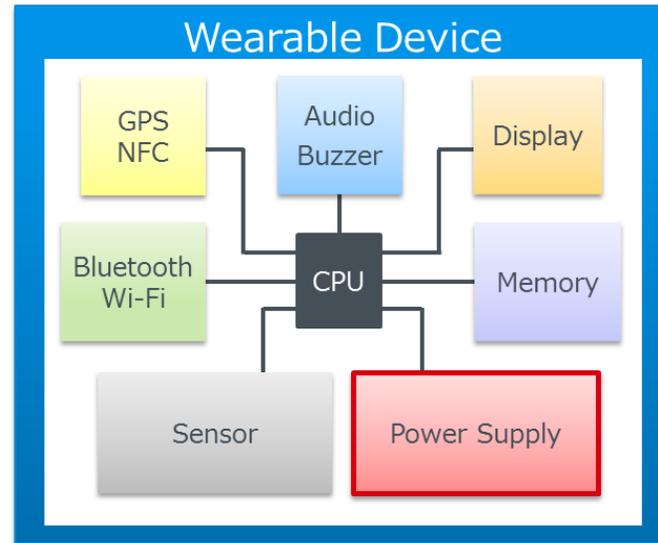
Wearable Market



Requires a low consumption power supply IC

Development Trends

- Improved safety
- Greater miniaturization
- Longer life

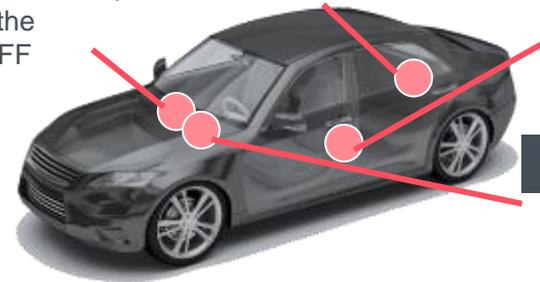


Automotive Market

Clock
Backup operation even when the display is OFF

Alarm System
Functions that operate when parked

Keyless
Functions that operate when parked



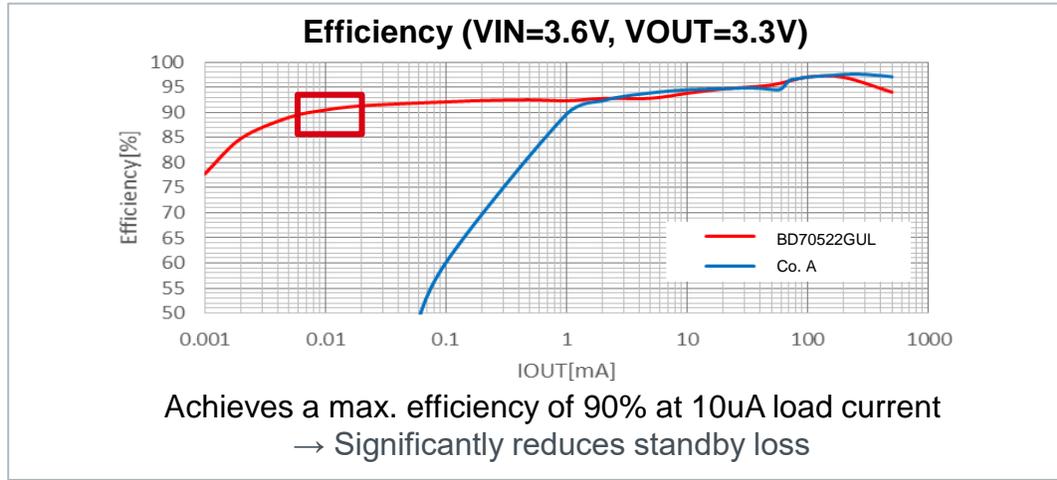
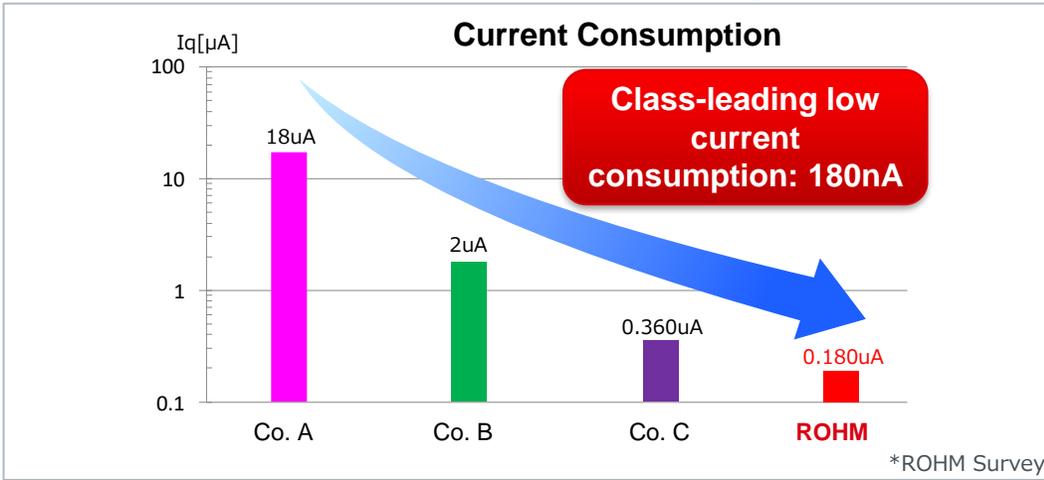
Car Navigation
Memory backup requires a power supply

Development Trends

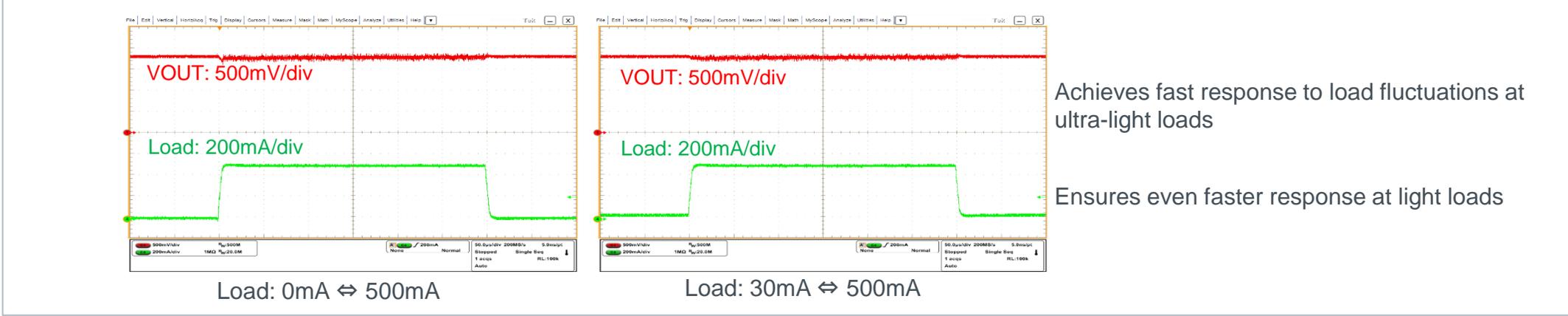
- Proliferation of EVs/HEVs
Low power consumption is required to improve fuel economy
- Idle stop
Stops the engine when the vehicle stops, with the battery providing the necessary power
- Increasing number of functions that operate when parked
Power supplied by battery may cause battery drain

Features of the BD70522GUL with Nano Energy™

Achieves ultra-low 180nA current consumption



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





Constant Demand of Power Supply ICs: The Need to Reduce the Number of Peripheral Components

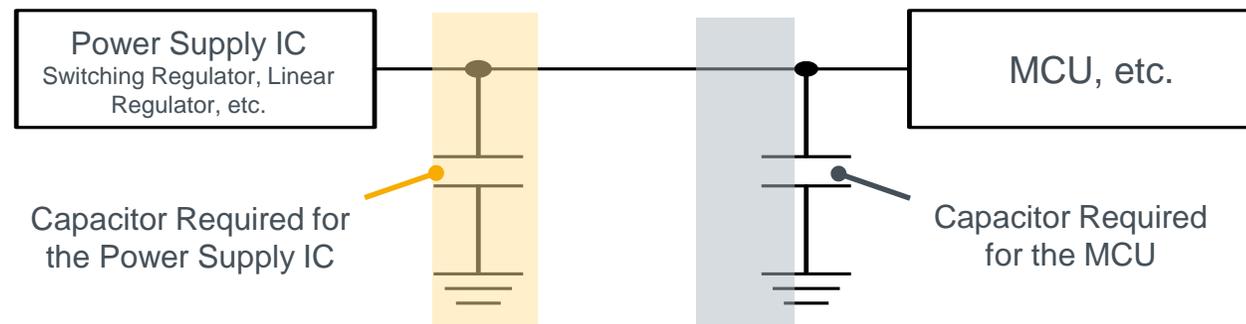
Solutions that Applications Require

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Solutions that Power Supply ICs Can Provide

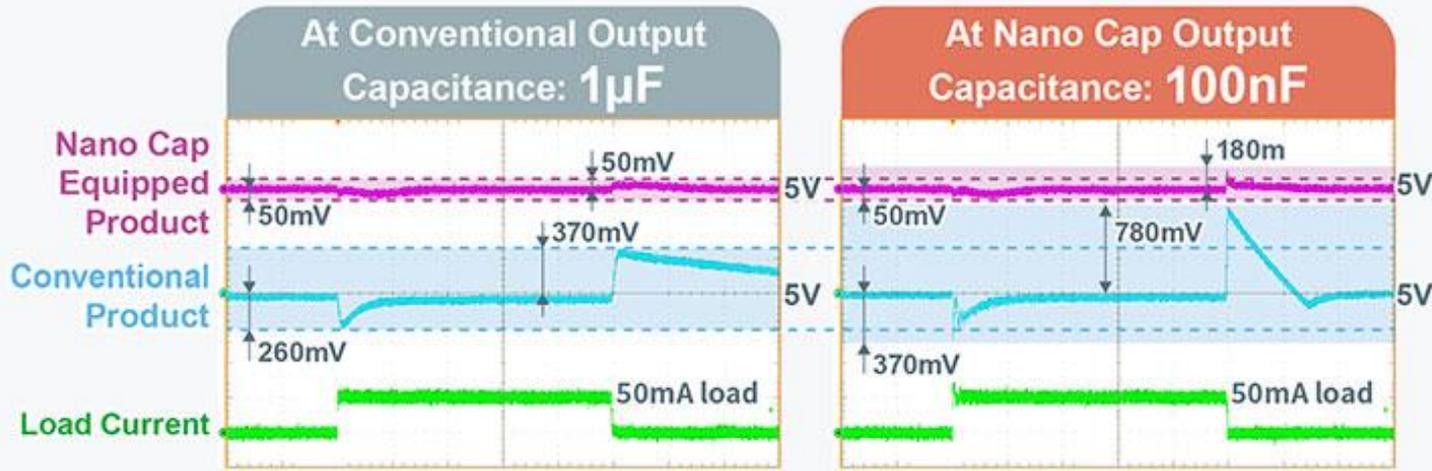
- High power conversion efficiency, low current consumption
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- Protection functions, long-term operation (high reliability)

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



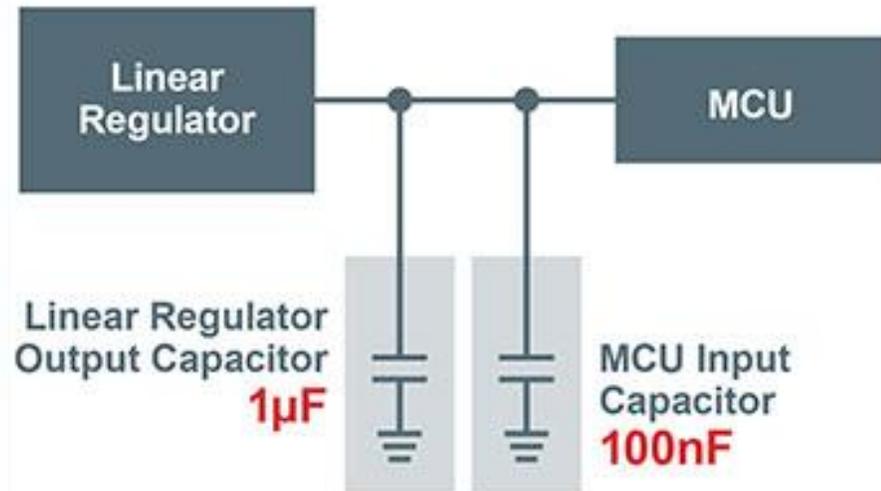
	At Conventional Output Capacitance: 1µF	At Nano Cap Output Capacitance: 100nF
	Max. Voltage Fluctuation	Max. Voltage Fluctuation
Nano Cap Equipped Product	±1.0% at 1µF	±3.6% at 100nF
(100nF Compatible) Conventional Product	±7.4% at 1µF	±15.6% at 100nF

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

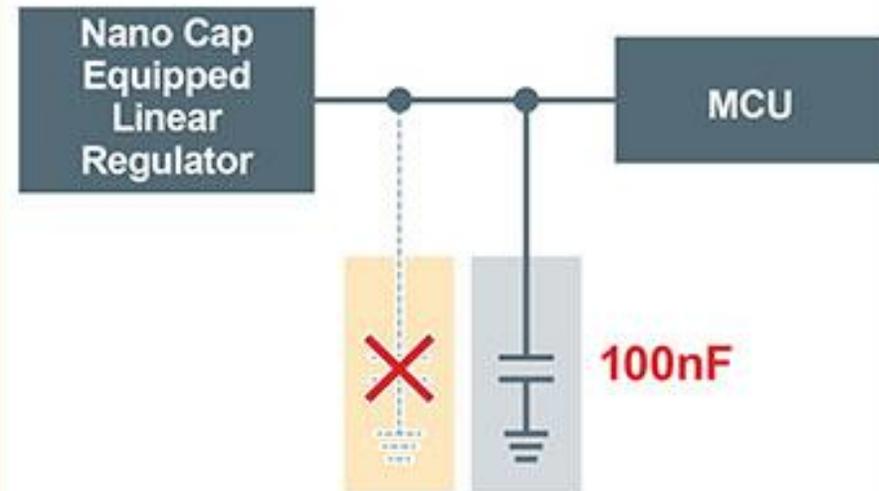
Nano Cap™ Solution

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"



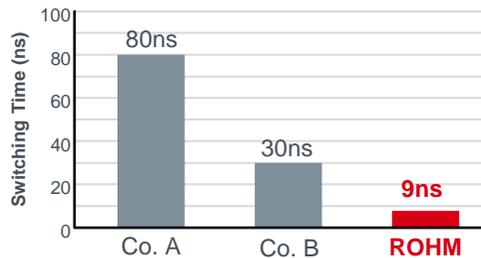
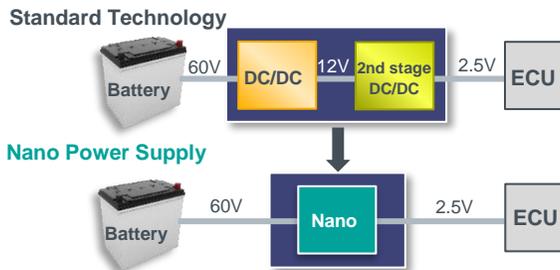
Nano Pulse Control™



Enables direct step-down from 60V to 2.5V

ns

Ultra-high-speed pulse control technology



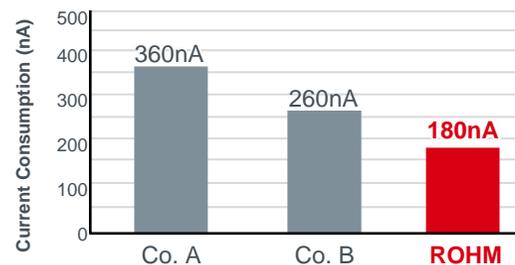
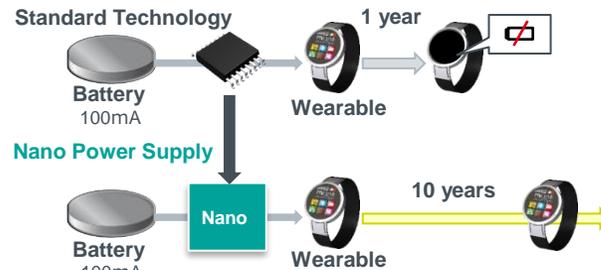
Nano Energy™



Provides 10-year drive on a single coin battery

nA

Ultra-low current consumption technology



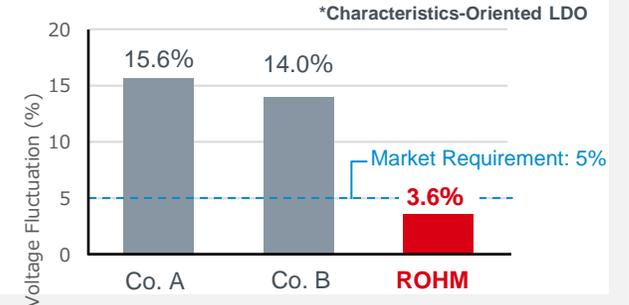
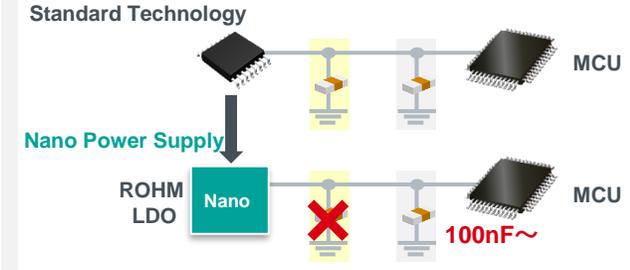
Nano Cap™



Eliminates stability issues related to capacitance

nF

Ultra-stable control technology



Solves issues by promoting adoption in power supply and other analog ICs



Electronics for the Future

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