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Automotive LDO Regulators Are Stable With 100-nF Output Capacitance

[ROHM Semiconductor's](#) 150-mA automotive LDO regulator ICs provide stable operation at "nanoscale" output capacitance. The BD9xxN1 series (which includes models BD950N1G-C, BD933N1G-C, BD900N1G-C, BD950N1WG-C, BD933N1WG-C, and BD900N1WG-C) is optimized for primary (direct connection to 12-V) power supplies in a wide range of applications, including powertrain, body, ADAS, and car infotainment.

In recent years, the continuing digitization of all types of equipment has been increasing the number of electronic components, which in turn has been driving the demand to reduce the number of capacitors used for circuit stabilization to shrink both the size and the bill of materials (BOM). This requires power supply ICs in power supply circuits that can achieve stable operation with small-sized capacitors, but until now it had been difficult to achieve stable operation in applications with output capacitances of 1- μ F or less.

To meet these needs, ROHM developed the Nano Cap ultra-stable control technology for power supply ICs in 2020. Leveraging this technology enables ROHM designers to develop LDO regulators that ensure stable operation even at ultra-small nanoscale output capacitances. This enables the support of an output capacitance of 100 nF—less than 1/10 of the value of standard products—ensuring stable operation required by applications (output voltage variation remains within 100 mV for a load variation of 1-mA to/from 50 mA in 1 μ s.) even when the input voltage and load current fluctuate (see Figs. 1 and 2).

In addition to common microfarad-order MLCCs and large capacitance electrolytic capacitors, ROHM's regulators can handle an ultra-wide range of output capacitances down to 1 μ F or less in the ultra-compact 0603/0402 size (which in the past had not been stable enough to be used), contributing not only to the miniaturization of components and boards, but also to a reduction of design resources needed by supporting a wider range of capacitor conditions.

The BD9xxN1 series of automotive primary LDOs meets the basic requirements of automotive products, such as operation above 125°C, qualification under the AEC-Q100 automotive reliability standard, and input voltages greater than 40 V for the primary power supply (see the table). Incorporating ROHM's Nano Cap control technology supports an output capacitance of 100 nF to ensure stable operation required by applications. This makes it possible to provide high performance with a good balance in terms of output capacitance range and response characteristics.

Going forward, ROHM is expanding the LDO regulator series with built-in Nano Cap technology to 22 models in different output voltages and packages by the end of FY2022. In 2023, another 24 models will be added to support 500-mA output current, for a total of 46 products by the end of FY2023, covering an even broader range of applications.

The BD9xxN1 series LDOs are available now in sample quantities with units available in production quantities starting in August. Parts are available from online distributors Digi-key, Mouser, and Farnell. For information on the series, see the Single-Output LDO Regulators [page](#), or see the individual product pages for the [BD950N1G-C](#), [BD933N1G-C](#), [BD900N1G-C](#), [BD950N1WG-C](#), [BD933N1WG-C](#), and [BD900N1WG-C](#).

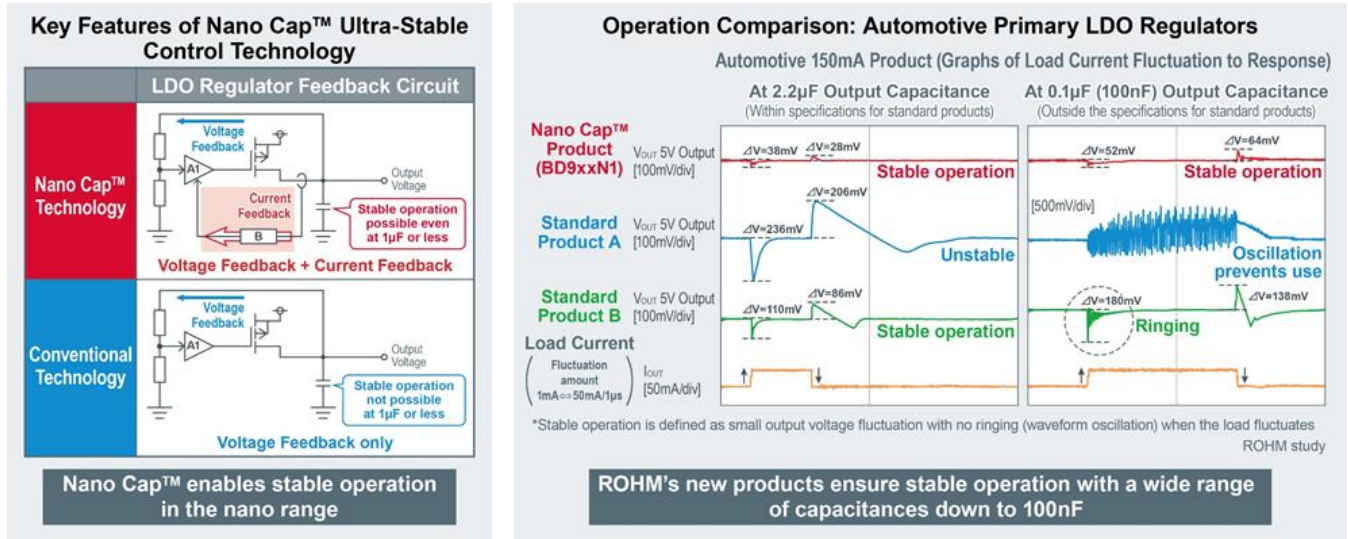


Fig. 1. Rohm's Nano Cap ultra-stable control technology combines advanced analog expertise covering circuit design, processes, and layout using ROHM's vertically integrated production system. Here the Nano Cap LDOs are compared with standard LDOs. The graph on the right shows Nanocap's response versus a standard LDO's response to load current variations.

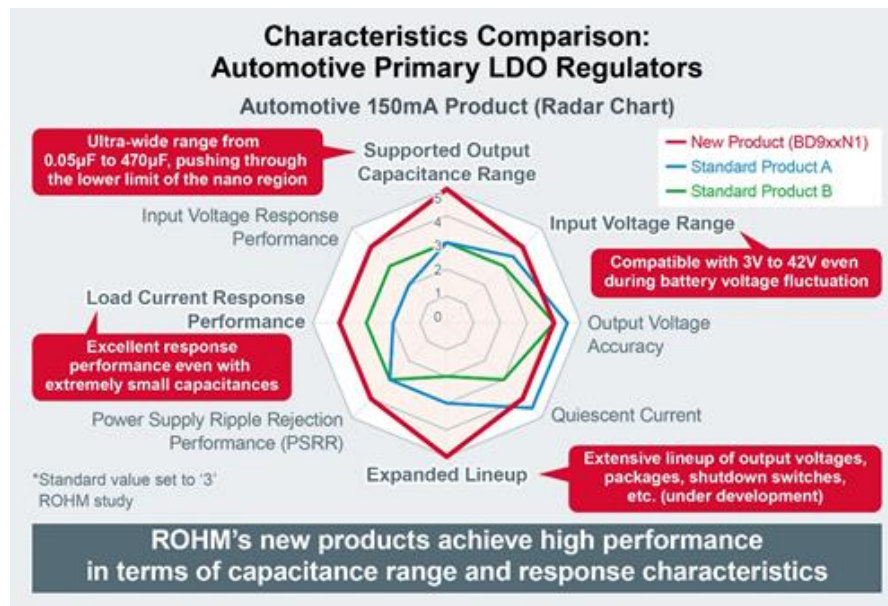


Fig.2. Further comparison of LDO characteristics for Rohm's automotive Nano Cap regulators versus standard LDOs.

Table. Key specifications for the BD9xxN1 series of automotive LDOs.

Part Number	Input Voltage [V]	Output Voltage [V]	Output Voltage Accuracy [%]	Output Current (Max.) [mA]	Output Capacitance [μF]	Quiescent Current (Typ.) [μA]	Shutdown Switch	Operating Temperature Range Tj [°C]	Package [mm]
New BD9xxN1G-C	3.0 to 42.0	3.3 / 5.0 / Adjustable (1.0 to 18.0)	±2	150	0.05 to 470	28	No	-40 to +150	SSOP5 (2.9×2.8×1.25)
New BD9xxN1WG-C							Yes		
☆ BD9xxN1EFJ-C							No	-40 to +150	HTSOP-J8 (4.9×6.0×1.00)
☆ BD9xxN1WEFJ-C							Yes		

*'xx' in the part number determined by the output voltage (e.g. 3.3V=BD933N~, 5.0V=BD950N~, Adjustable=BD900N~)

☆: Under Development