

# Single-Inductor Dual-Output DC-DC Converter Design with Exclusive Control

Yasunori Kobori, Murong Li, Qiulin Zhu, Feng Zhao, Zachary Nosker  
Shu Wu, Shaiful N. Mohyar, Haruo Kobayashi, Nobukazu Takai

<sup>1</sup>Department of Electronics, Graduate School of Engineering, Gunma University  
1-5-1 Tenjin-cho, Kiryu 376-8515, Japan e-mail: t12801681@gunma-u.ac.jp

DC-DC converters are indispensable for virtually all electronic devices, from cell phones to large manufacturing machinery. Single-inductor multi-output (SIMO) converters have been recently reported, especially dual output (SIDO) converters [1-3].

In this paper we propose a new control method for SIDO converters which requires few additional components (a switch, a diode and a comparator), while not requiring current sensors of the inductor or the loads. We introduce their operating principles and show simulation results to verify their basic operation and performance.

We describe here two types of SIDO converters: a buck-buck and a boost-boost converter. As an example, we explain principles of operation with buck-buck converter in Fig1. Simulation results show that the static output voltage ripple is less than 20mVpp and the transient voltage ripple is less than 60mVpp ( $\Delta I = 1A$ ) for the buck-buck type SIDO converter. For the boost-boost type SIDO converter, they almost have the analogous principle of operation. The static ripple is less than 30mVpp and the transient ripple is less than 80mVpp ( $\Delta I = 1A$ ). We have also performed experiments which verify the effectiveness of the proposed method.

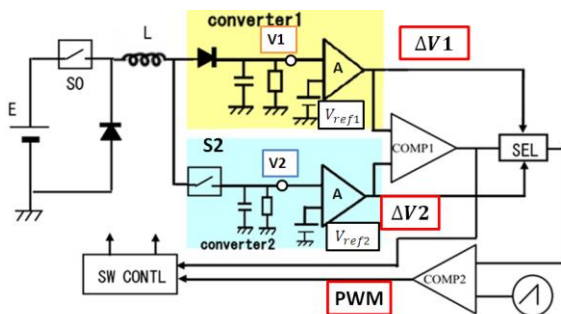


Fig. 1: Proposed SIDO with two buck converters.

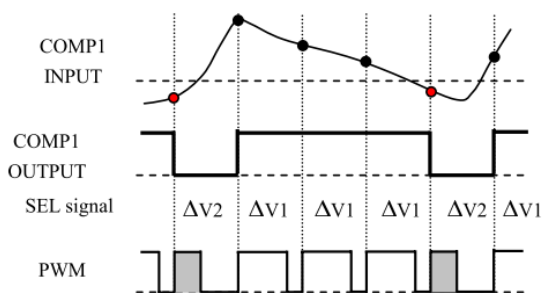


Fig 2:Timing chart of the circuit in Fig.1.

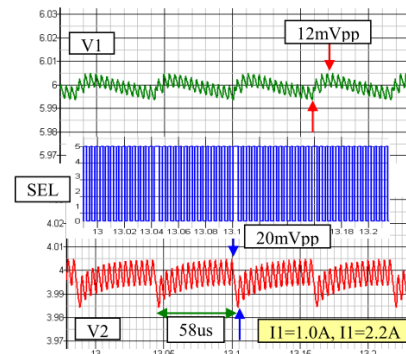


Fig 3: Simulated transient responses V1, V2 (Fig. 1).

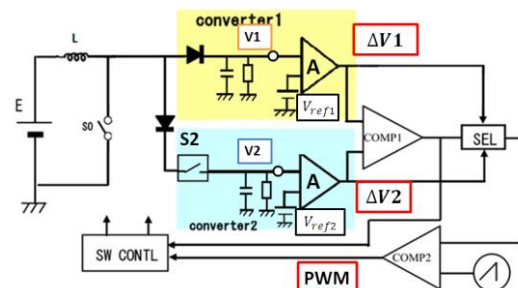


Fig. 4: Proposed SIDO with two boost converters.

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- [2] Y. Kobori, F. Zhao, Q. Li, M. Li, S. Wu, Z. Nosker, S. N. Mohyar, N. Takai, H. Kobayashi, T. Odaguchi, I. Nakanishi, K. Ueda, J. Matsuda, "Single Inductor Dual Output Switching Converter using Exclusive Control Method", IEEE Asia Pacific Conference on Circuits and Systems, Kaohsiung, Taiwan (Dec. 2012).
- [3] K. Takahashi, H. Yokoo, S. Miwa, K. Tsushida, H. Iwase, K. Murakami, et al, "Single inductor DC-DC Converter With Bipolar Outputs Using Charge Pump," IEEE Asia Pacific Conference on Circuits and Systems, pp. 460–463, Kuala Lumpur, Malaysia (Dec. 2010)