

Phase Changing Method of Multi-Phase Buck Type Switching Converter

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We propose a switching method of a four-phase buck type switching converter that changes the operating phase according to its output current. Novelty of the proposed circuit is to add a constant current operation mode in addition to two modes of stop and constant voltage in control of each phase. Fig.1 shows its configuration while Fig. 2 shows its operation. In Fig. 1, the output current I_{out} is detected as the setting method of the priority sequence; when this current reaches the target current I_{th} , the second phase circuit starts to operate, and the first phase circuit changes to the constant current mode of I_{th} . By providing the priority order signal also in the case of $2I_{th}$ and $3I_{th}$, when the load current I_{out} gradually increases, the switching converter of each phase sequentially operates in addition to the first phase switching converter. Conversely, when the load current decreases, the operation stops sequentially from the fourth phase switching converter.

In the system where four phases operate at the same time, efficiency improvement was remarkably difficult, because converters of all phases operate even at low load. By setting priorities for converters of each phase, it is possible to reduce unnecessary power consumption of the switching elements at low load and to achieve high efficiency. However, in the method of sequentially stopping from the conventional low priority phase converter (converter 4 in Fig. 1), the current of the phase which continues operation is not maintained and the output voltage is disturbed.

In this method, by always setting one converter to operate at constant voltage, only one phase changes the output current and hence the disturbance of the output voltage is reduced compared to the conventional one where multiple phases change the output current.

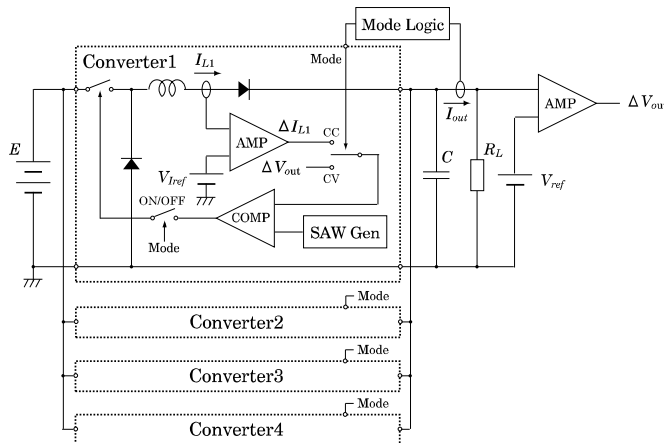


Fig. 1 : Block diagram of the proposed four-phase converter

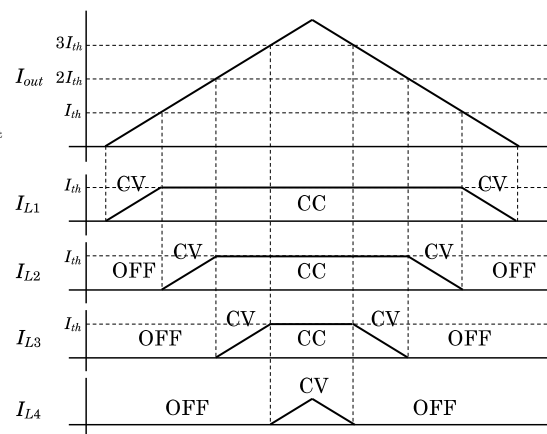


Fig. 2 :Operation of the proposed four-phase converter

1. Reference

Y. Kobori, Y. Sun, Y. Xiong, N. Tsukiji, N. Takai, Haruo Kobayashi, "Multi-Phase Buck Type Switching Converter with Adaptive Phase Change According to Output Current," 8th Tochigi and Gunma Area Workshop, The Institute of Electrical Engineers of Japan (IEEJ), Kiryu (March 2018)