

A Single-input Multiple-output SC Converter for Energy-Efficient Word-line Driver in 3D NAND Flash PIM

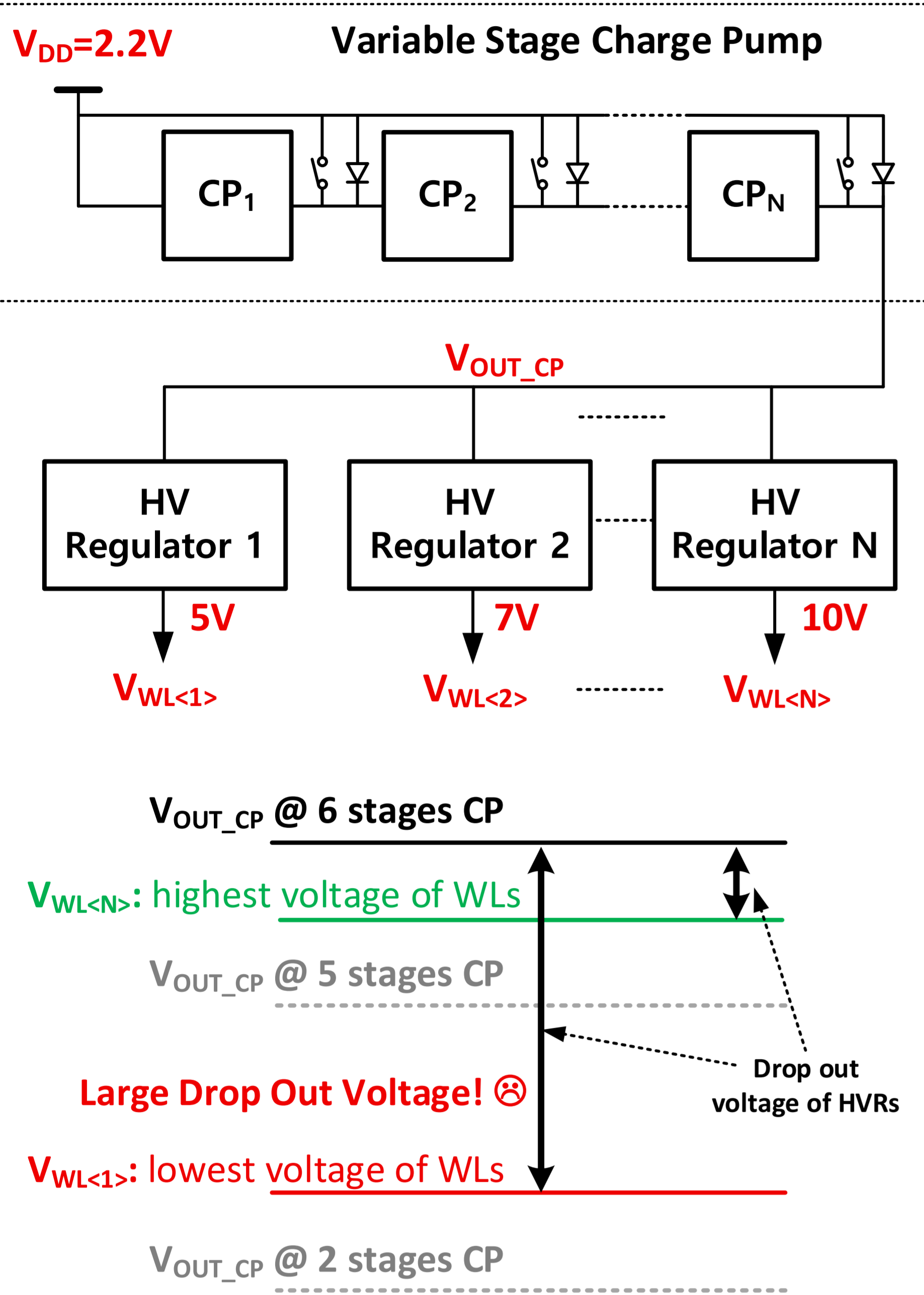
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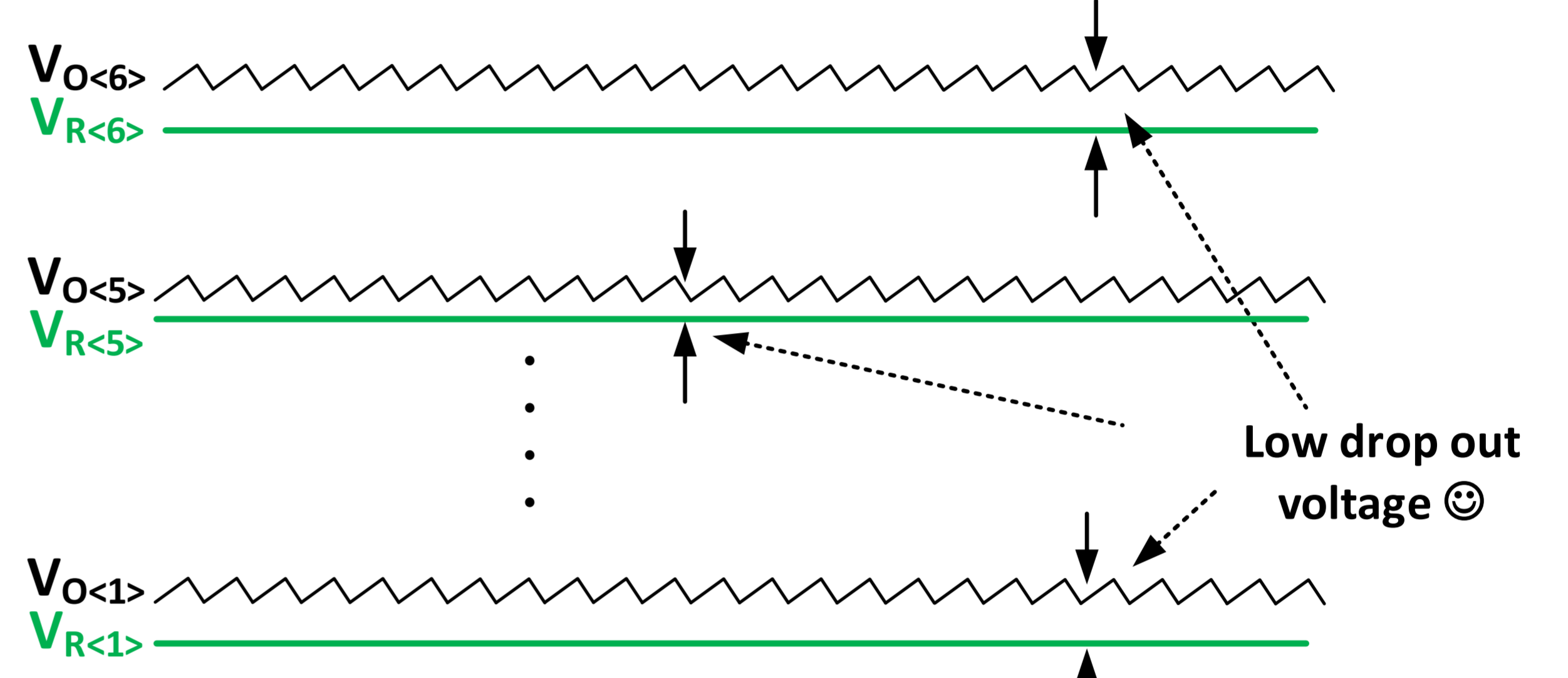
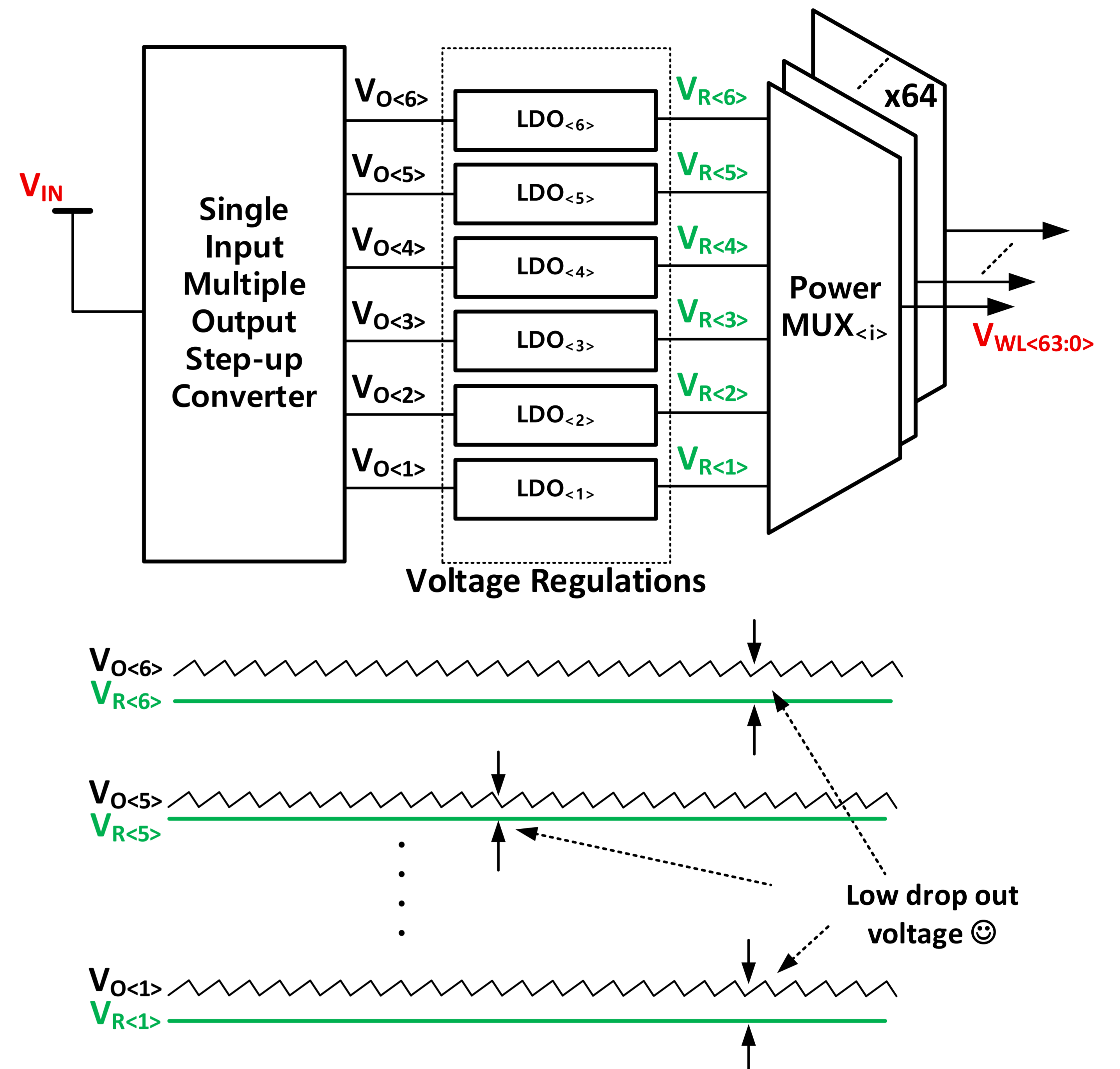
Motivation



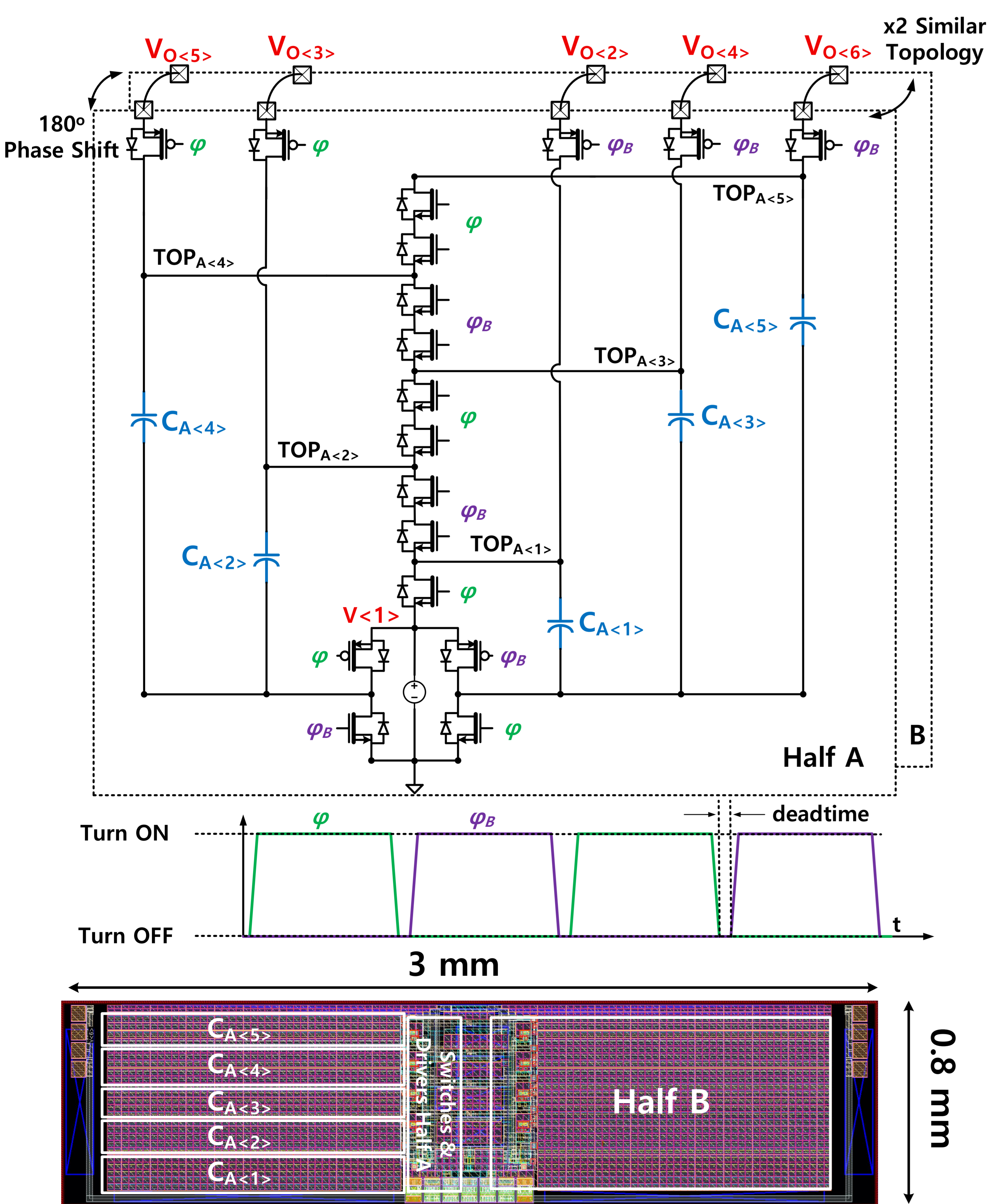
Conventional PDN in WL Drivers of NAND Flash

- ❑ In-efficient variable stage charge pumps
 - ❑ High voltage regulator: High drop-out voltage for low voltage WL drivers
 - ❑ Low responding time in WLs voltage driver
- Low energy efficiency high power PDN in WL drivers ☹️
- Low speed NAND Flash operation ☹️

Presented PDN in WL Drivers



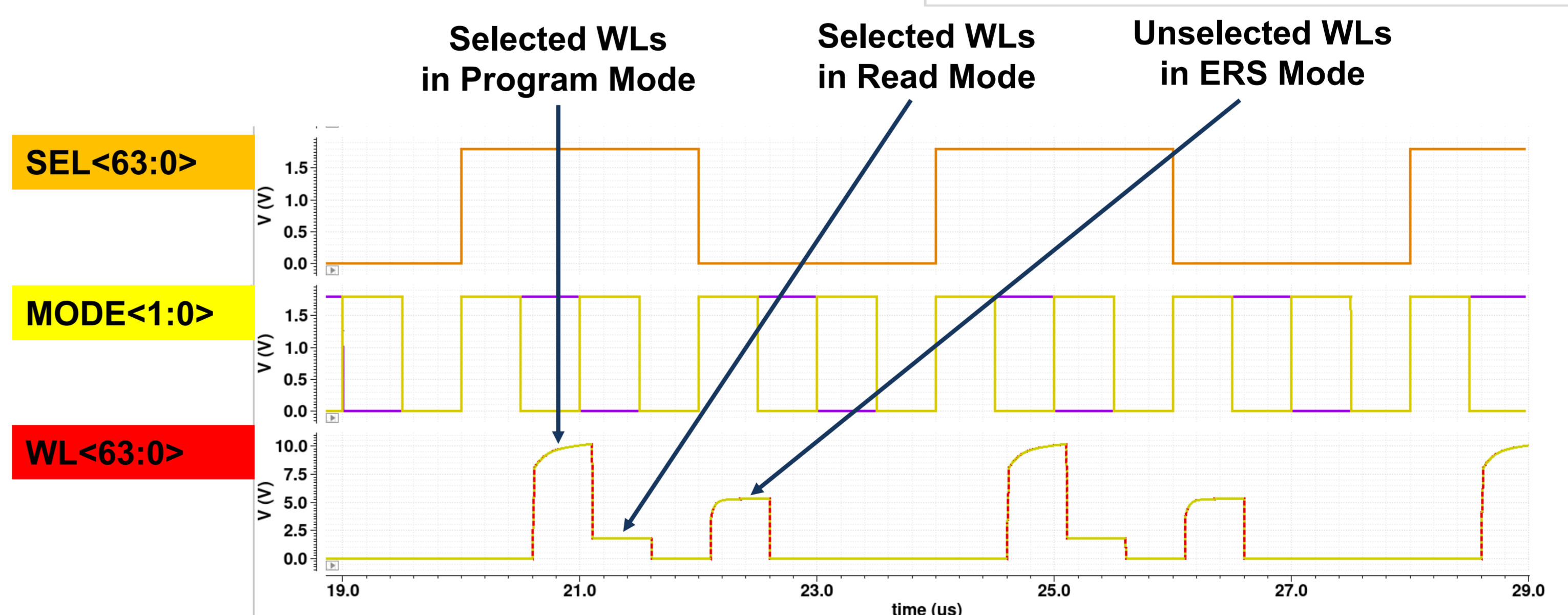
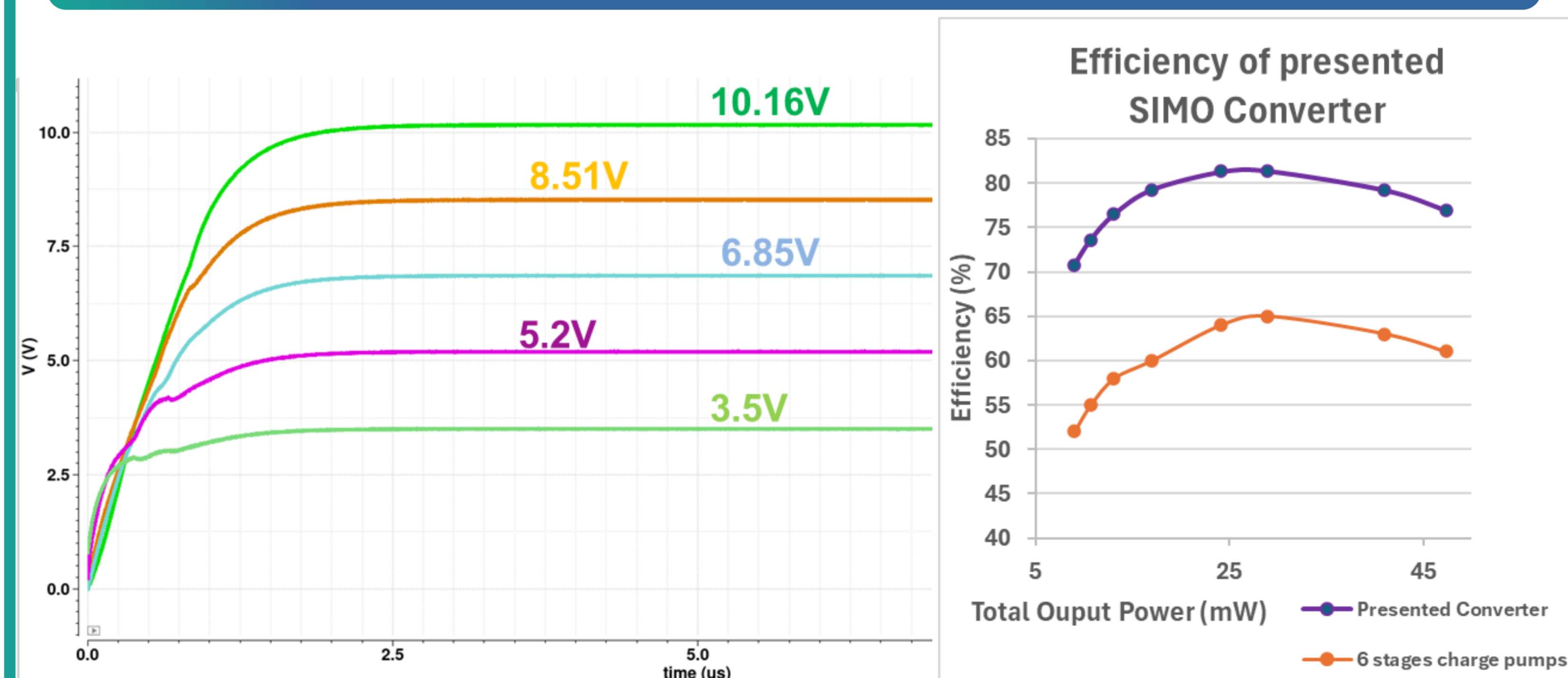
Presented SIMO Converter



Presented PDN in WL Drivers

- ❑ High efficiency SIMO Converter
 - ❑ Low voltage regulation for each output of SIMO Converter
 - ❑ Power MUX for WL voltage selection
- High energy efficiency high power PDN in WL drivers 😊
- High speed NAND Flash operation 😊
- Energy efficient high density 3D NAND Flash for PIM 😊

Results



- ❑ > 70% energy efficiency @ 10~50mW output power 😊
- ❑ Up to tens of Mhz operation for 3D NAND Flash 😊

- ❑ Dickson-like switches configuration: No short circuit power transfer like conventional charge pumps
 - ❑ Switch designs based low voltage CMOS components
- High energy efficiency over wide range load 😊

[1] W. Shim and S. Yu in IEEE Journal on Emerging and Selected Topics in Circuits and Systems, vol. 12, no. 2, pp. 500-507, June 2022
 [3] 정현식, AU – SeongHwan Cho (2021) in IDEC Journal of Integrated Circuits and Systems, 7(4), 39 - 43.
 [4] Sam-Kyu Won et al in IEEE Asian Solid-State Circuits Conference 2011 - (ASSCC), Jeju, South Korea, 2011, pp. 169-172.