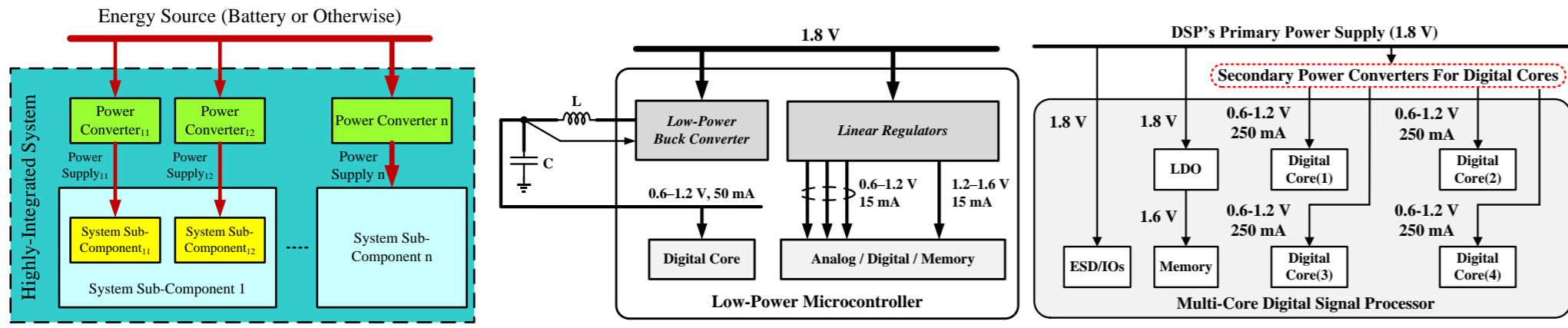


Motivation

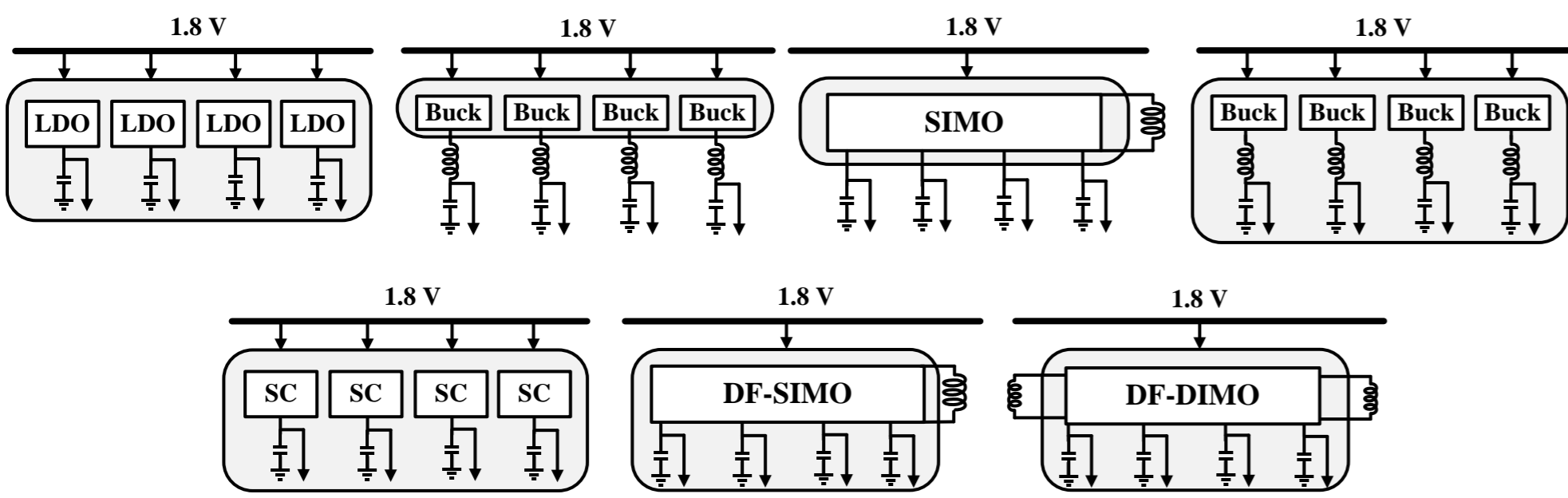
On-Chip Dynamic Power Grids

- Large number of power supplies in SoCs
- Many need to be dynamic
- On-chip integration
- High efficiency and wideband operation

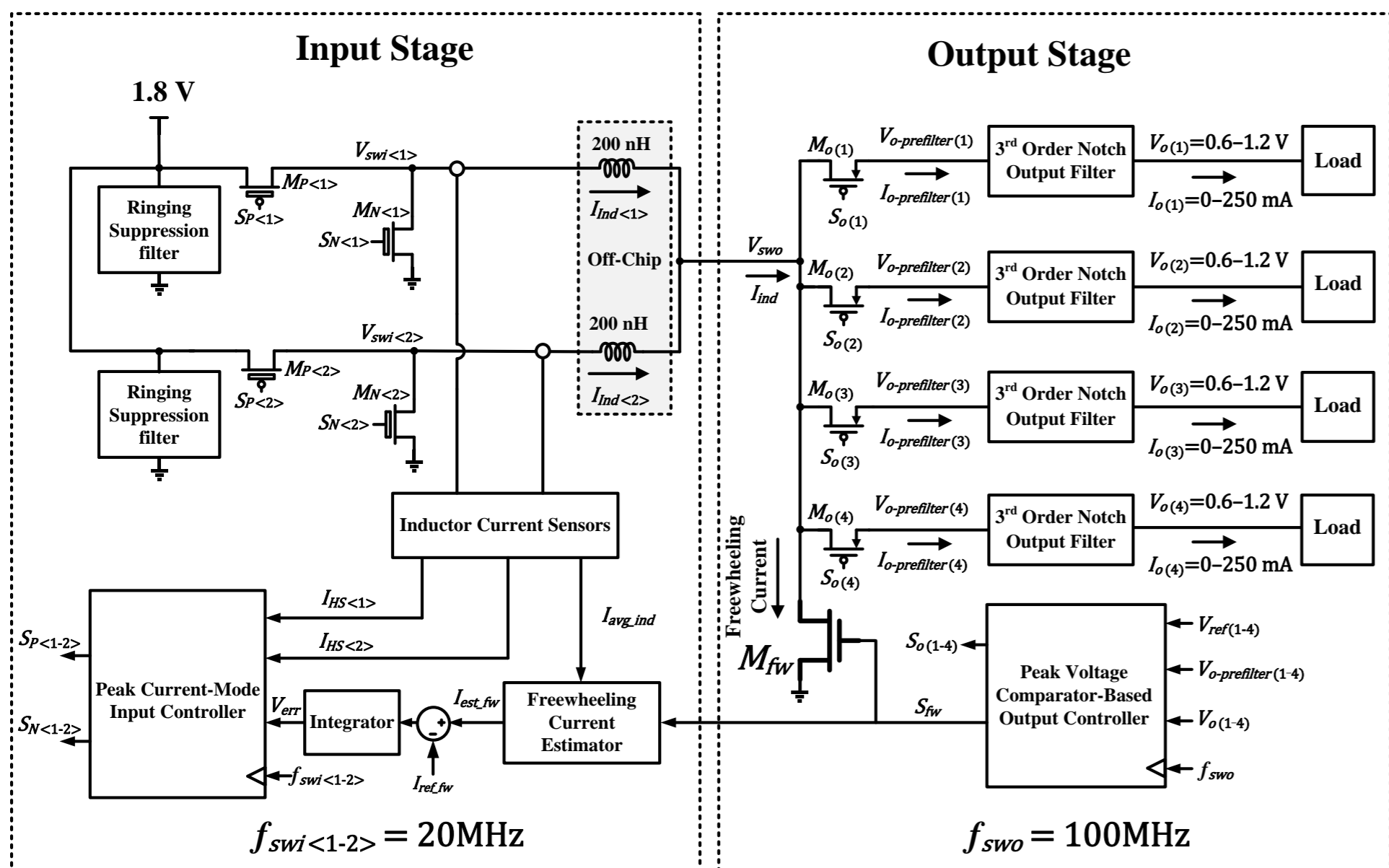
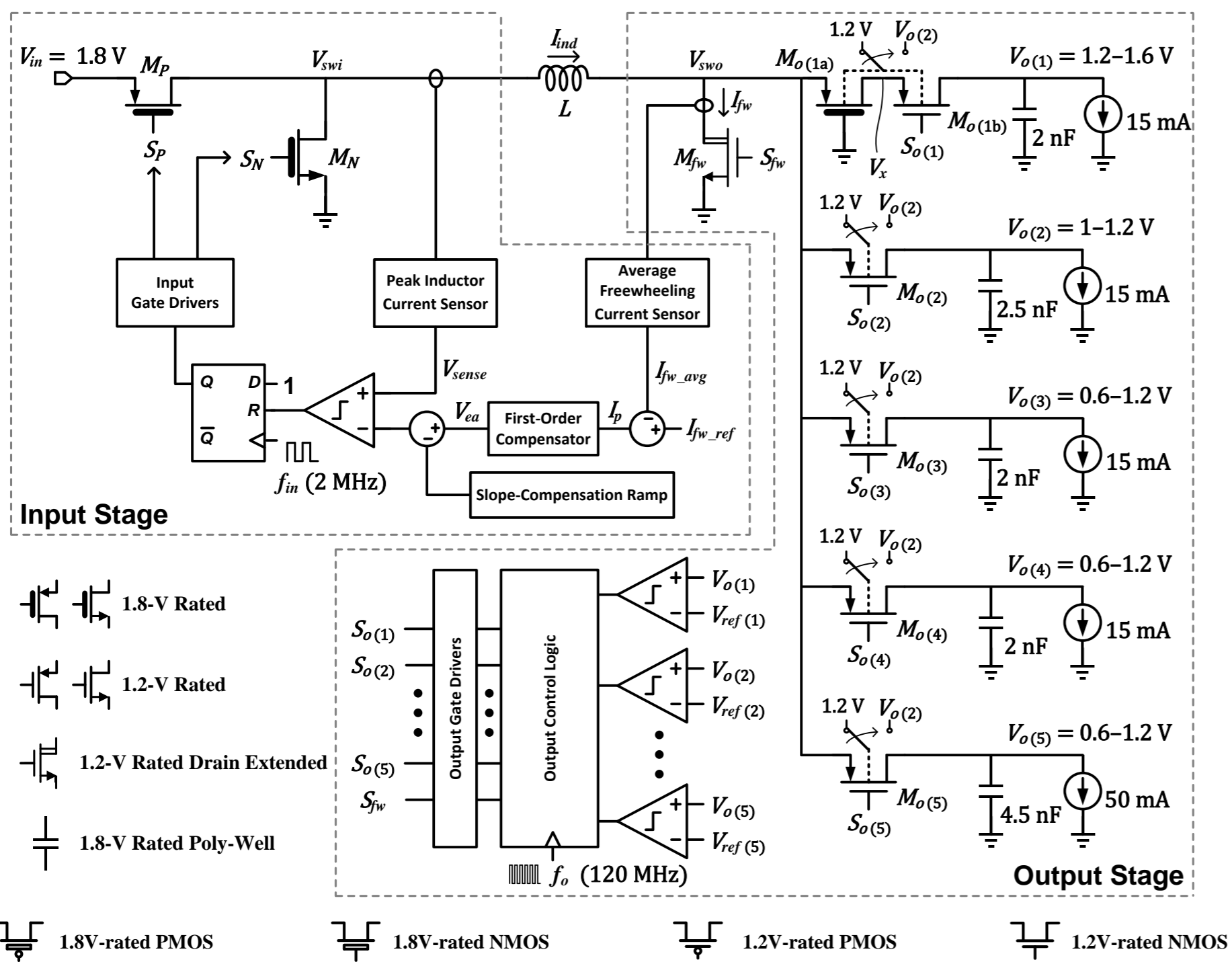


Solutions

- On-chip LDOs
- Conventional buck converters
- Conventional SIMO converters
- High-frequency buck converters
- High-frequency SC converters
- Proposed DF-SIMO/MIMO converters



DF-SIMO/MIMO Topologies: Design

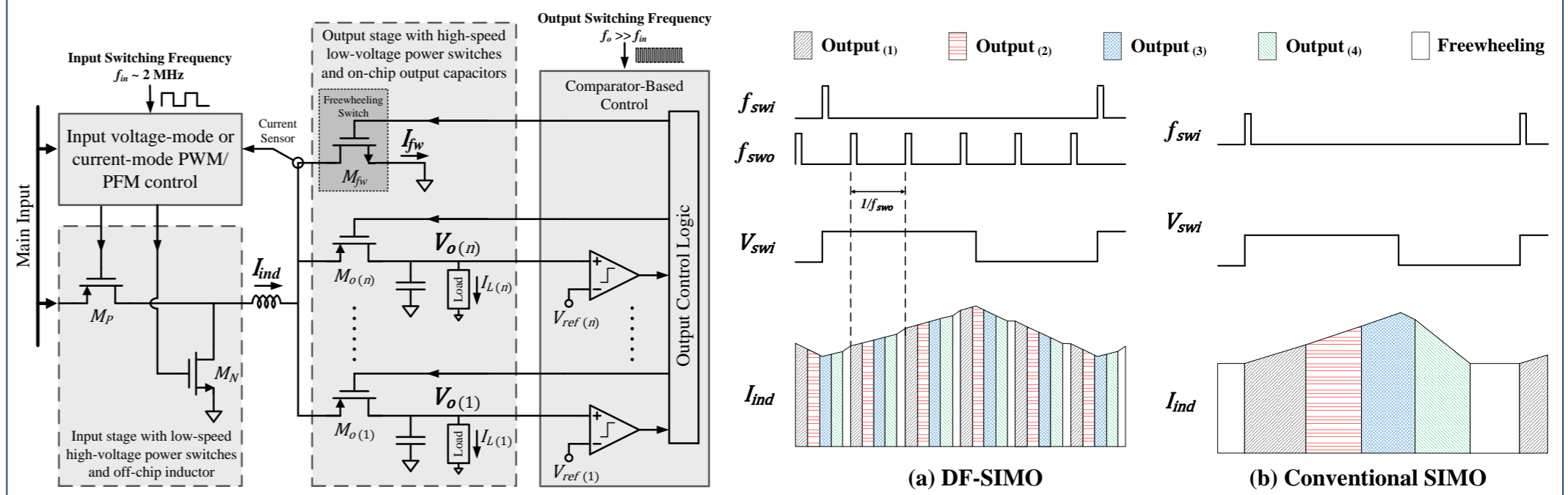


KEY CONTRIBUTIONS

- Multiple fully-integrated outputs (4, 5, and 10)
- Fast dynamic operation with no cross-regulation transients
- Minimal number of inductors
- Suitable for both light and heavy loads

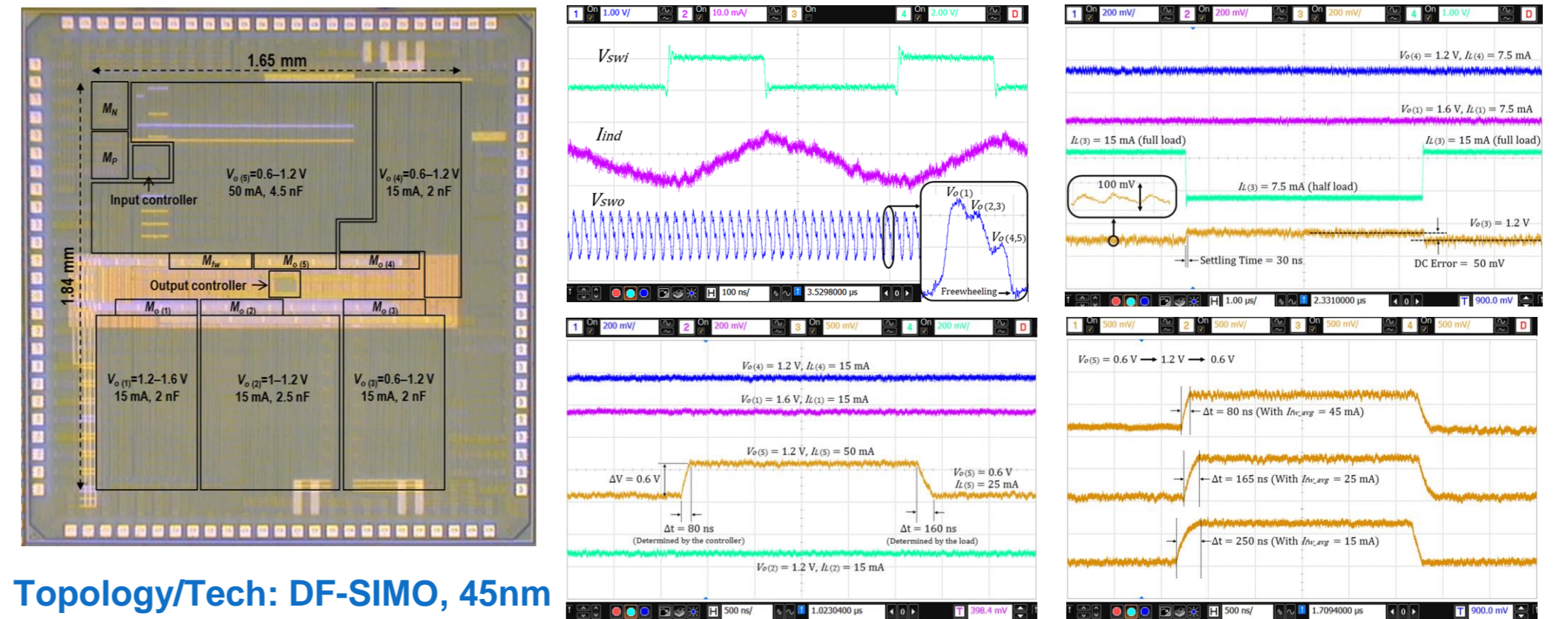
DF-SIMO/MIMO Topologies: The Concept

- ◆ Decouple the power conversion rate at the input stage from the power conversion rate at the output stage



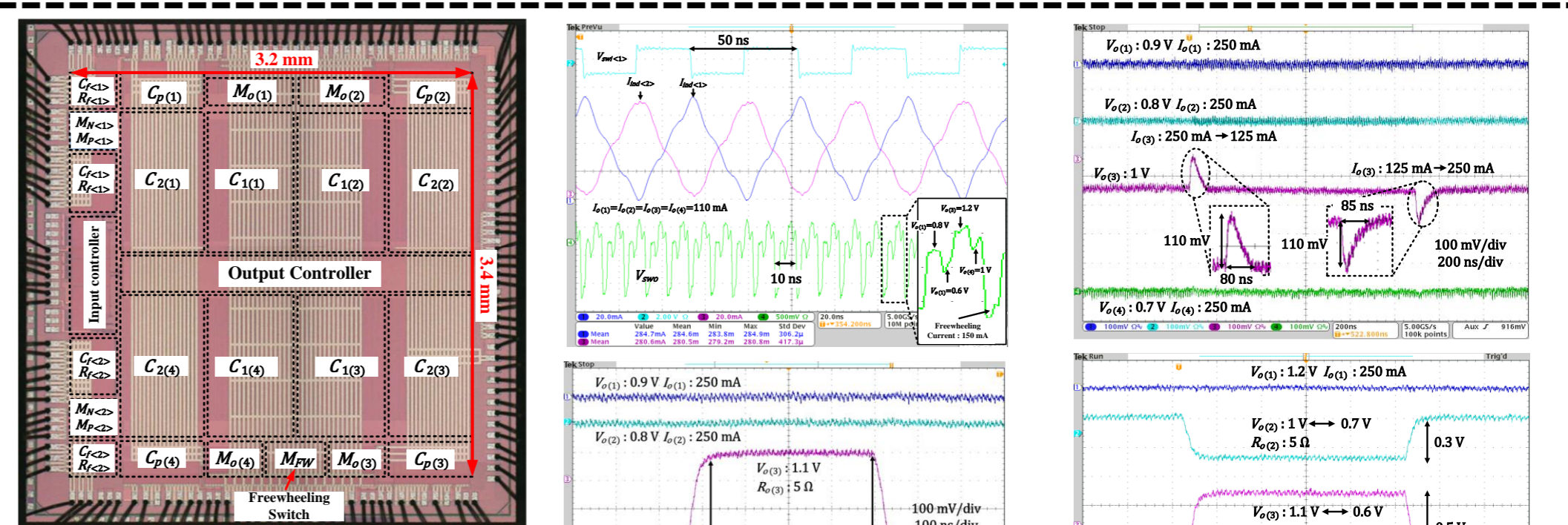
- ◆ Low Input Switching Frequency
 - High-voltage power devices to handle high input voltage with low switching losses
- ◆ High Output Switching Frequency
 - Low-voltage power devices reduce switching losses
 - Fast output dynamic response
 - Outputs can be integrated on-chip
- ◆ Freewheeling Switch
 - Compensate for slow input stage through current reserve
 - Fast output dynamic response
 - Eliminate cross-regulation transient

DF-SIMO/MIMO Topologies: Measurements



Topology/Tech: DF-SIMO, 45nm
Outputs: 5, 0.6-1.6V
Input: 1.8V
Max Load: 125mA

C.-W. Chen and A. Fayed, "A Low-Power Dual-Frequency SIMO Buck Converter Topology with Fully-Integrated Outputs and Fast Dynamic Operation in 45-nm CMOS," IEEE JSSC, Sept. 2015.



Topology/Tech: DF-DIMO, 65nm
Outputs: 4, 0.6-1.2V
Input: 1.8V
Max Load: 1A

Y. Jiang and A. Fayed, "A 1A, Dual-Inductor 4-Output Buck Converter with 20-MHz/100-MHz Dual-Frequency Switching and Integrated Output Filters in 65nm CMOS," IEEE JSSC, Oct. 2016.

Acknowledgements/Contacts

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Sita Asar, Hua Zhang, and Ayman Fayed, Power Management Research Lab, The Ohio State University, Columbus, Ohio, USA.
Asar.2@osu.edu, Zhang.8230@osu.edu, Fayed.1@osu.edu