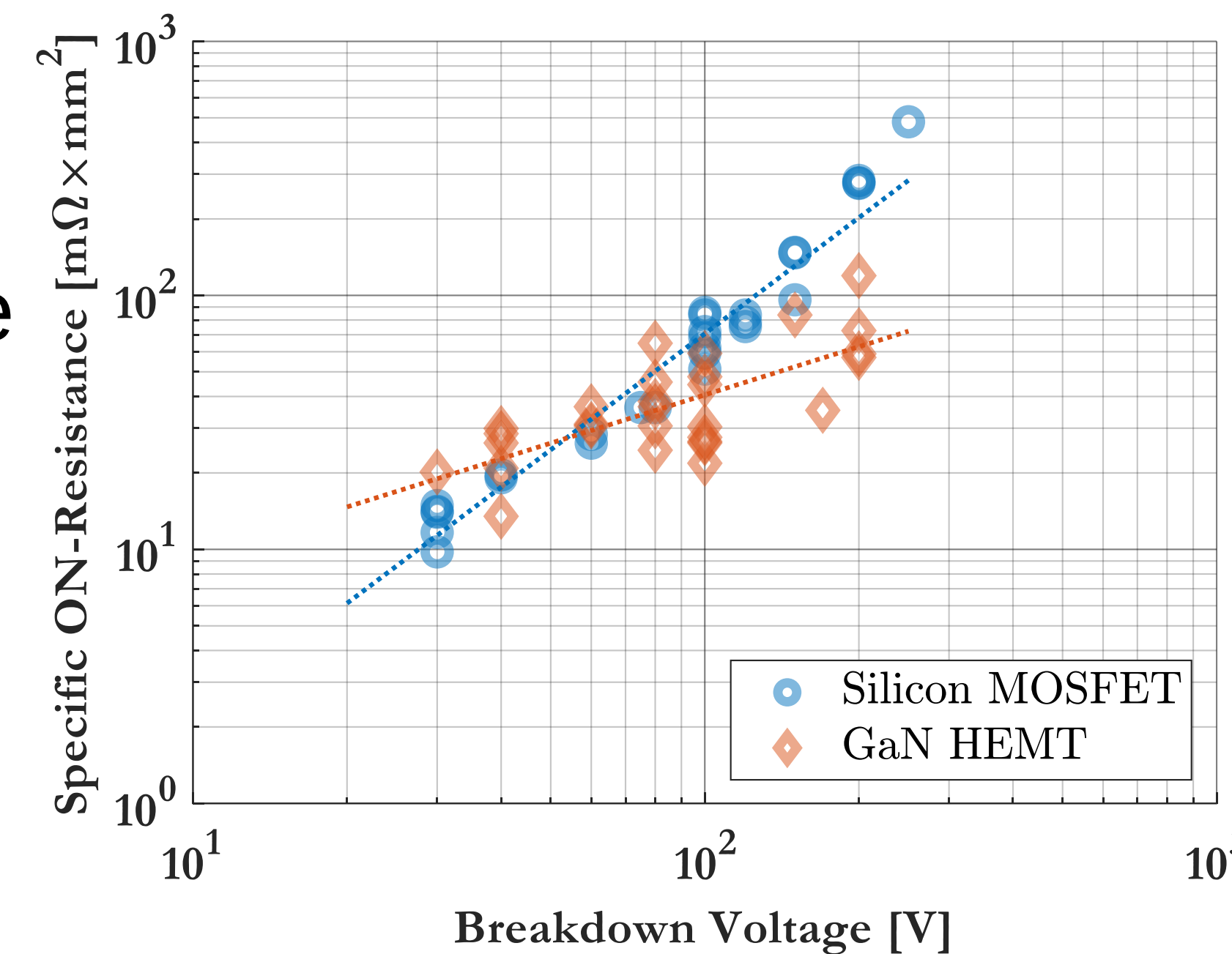


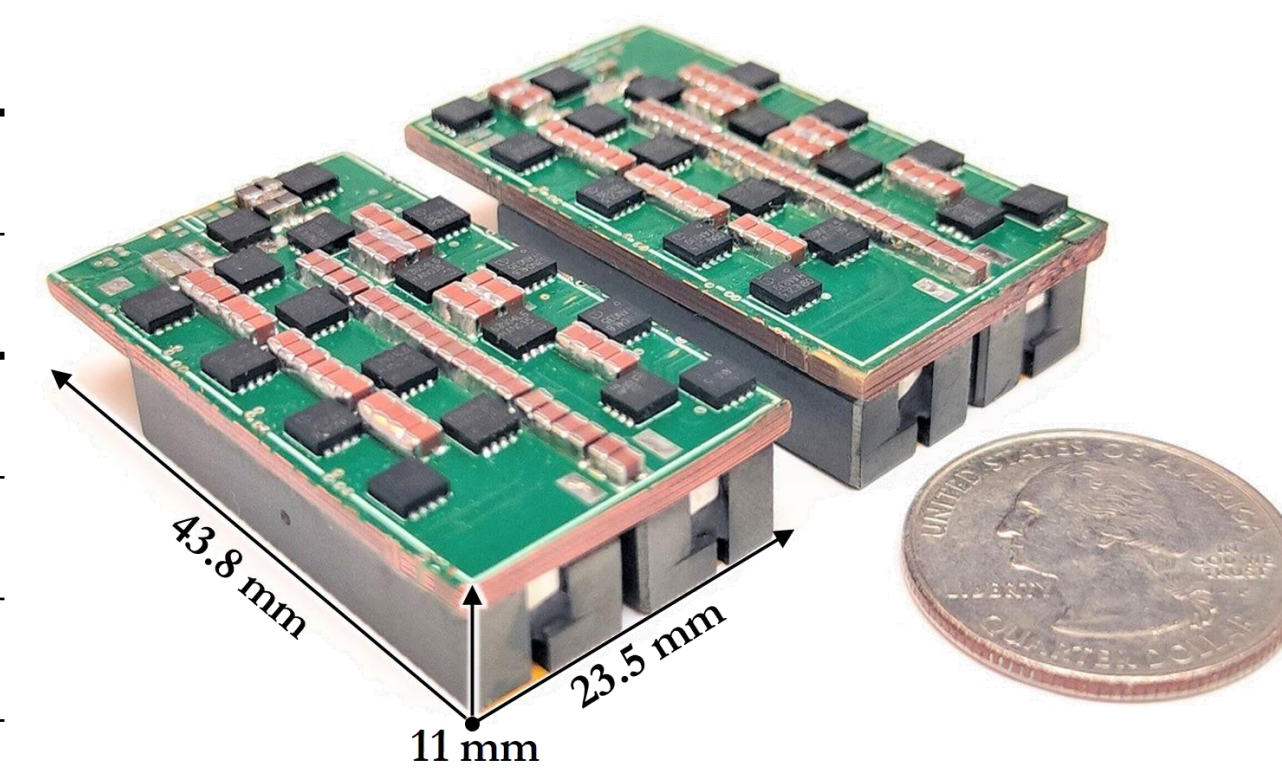
MOTIVATION

- Devices with lower breakdown voltage: lower on-resistance and switching loss.
- Enables higher f_s : smaller passive components, fully integration.
- Advanced 48 V VIB-PoL topology to reduce the device voltage stress.

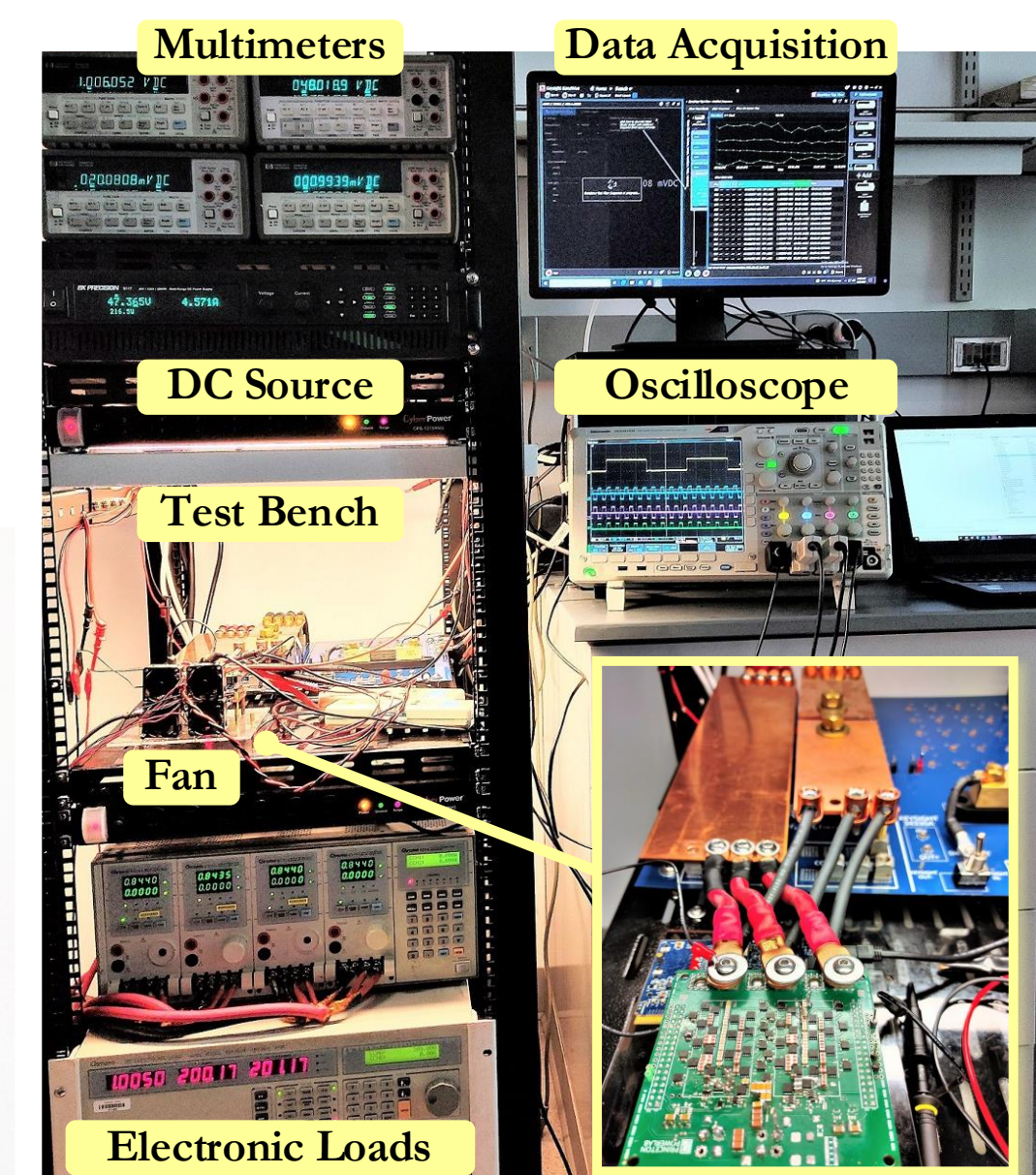


DESIGN DETAILS

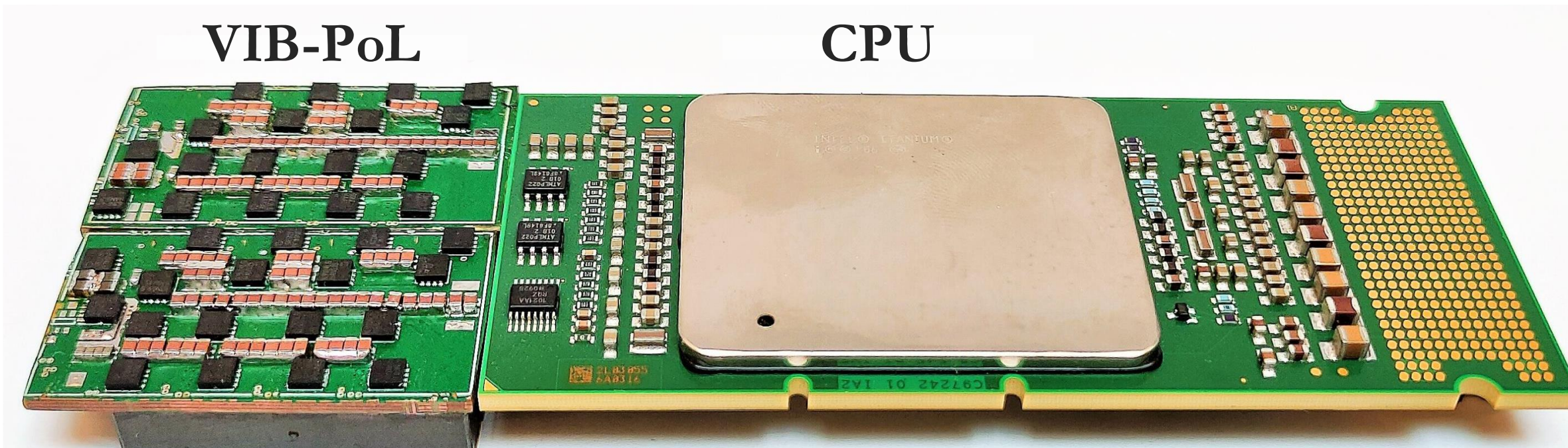
Max. I_o	Air cooling: 450 A; Liquid cooling: 640 A
f_s	Charge Pump: 92.6 kHz; Series-cap buck: 417 kHz
$Q_1 - Q_8$	Infineon BSZ024N04LS6, 40 V/2.1 mΩ
C_{F1} & C_{F1}	0805 35 V/22 μ F $\times$ 16, C_{eff} = 23.4 μ F
C_{IB}	0603 35 V/4.7 μ F $\times$ 22, C_{eff} = 10 μ F
C_{1X}	0805 25 V/10 μ F $\times$ 8, C_{eff} = 21.6 μ F
C_{2X}	0805 25 V/10 μ F $\times$ 6, C_{eff} = 25.2 μ F
C_{3X}	0805 25 V/10 μ F $\times$ 4, C_{eff} = 29.2 μ F
$L_{1X} - L_{4X}$	CL1108-4, 4-Phase Coupled, L_K = 50 nH
$S_{1X} - S_{4X}$	Infineon BSZ031NE2LS5, 25 V/2.6 mΩ
$S_{5X} - S_{8X}$	Infineon BSZ011NE2LS5I, 25 V/0.82 mΩ



Picture of the 48 V-1 V/640 A VIB-PoL CPU voltage regulator



Picture of the test bench and the measurement setup



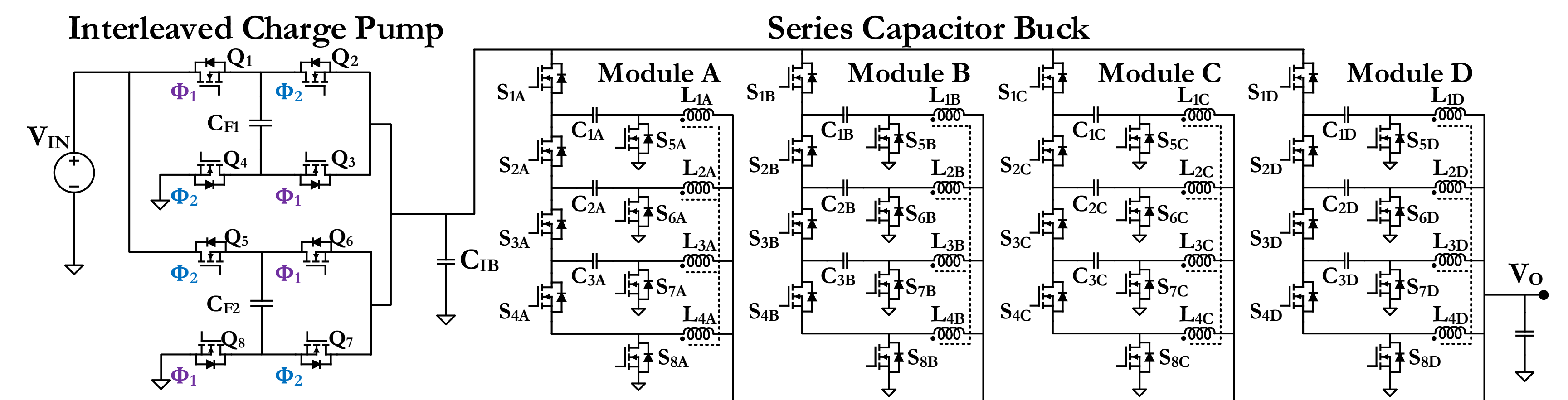
Mechanical demonstration of the 48 V-1 V 640 A VIB-PoL voltage regulator placed next to a server CPU (Intel Itanium 9150, 105-W).

KEY CONTRIBUTIONS

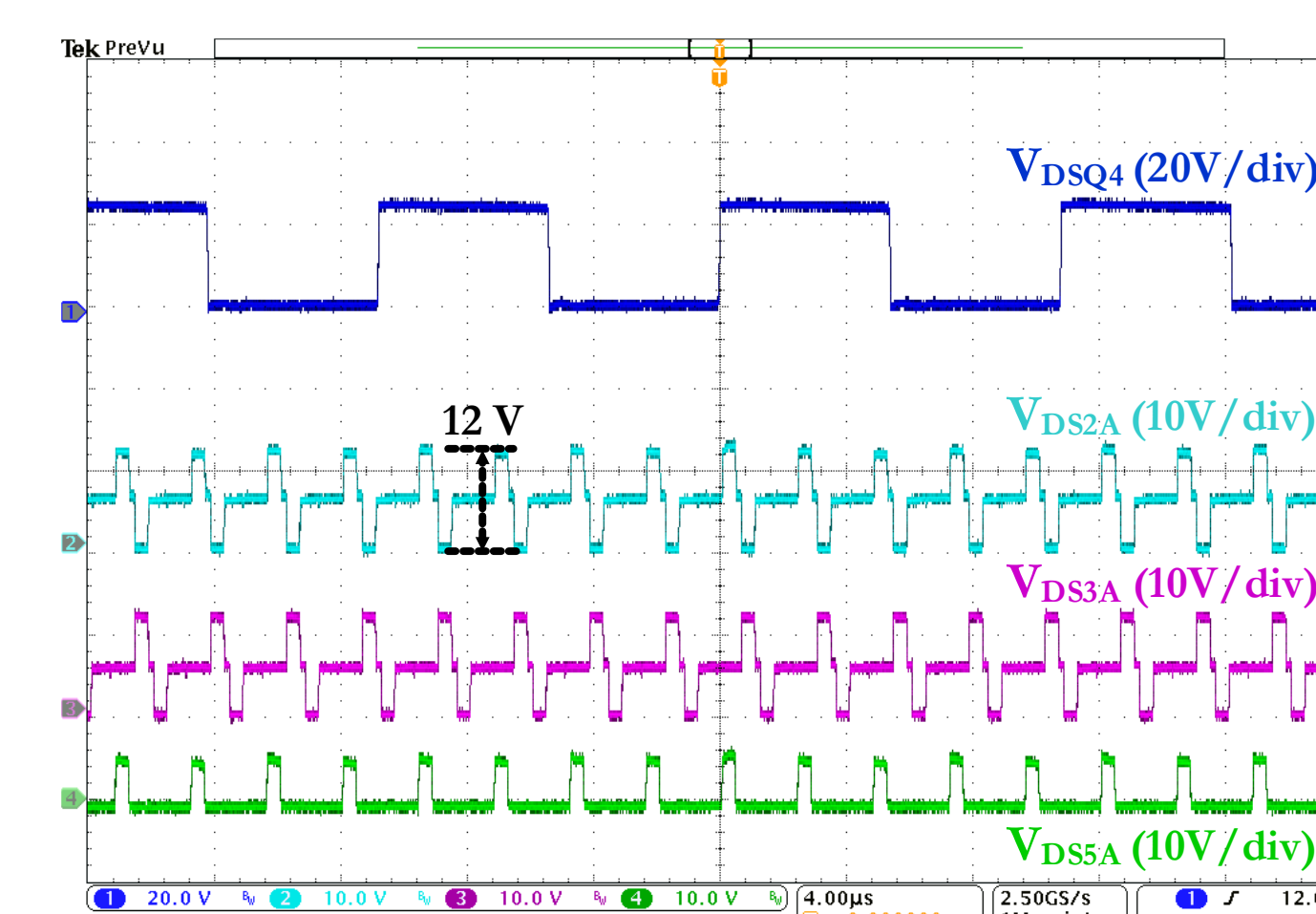
VIB-PoL architecture reduces device voltage stress, achieves high efficiency and power density.

VIRTUAL INTERMEDIATE BUS (VIB) POL

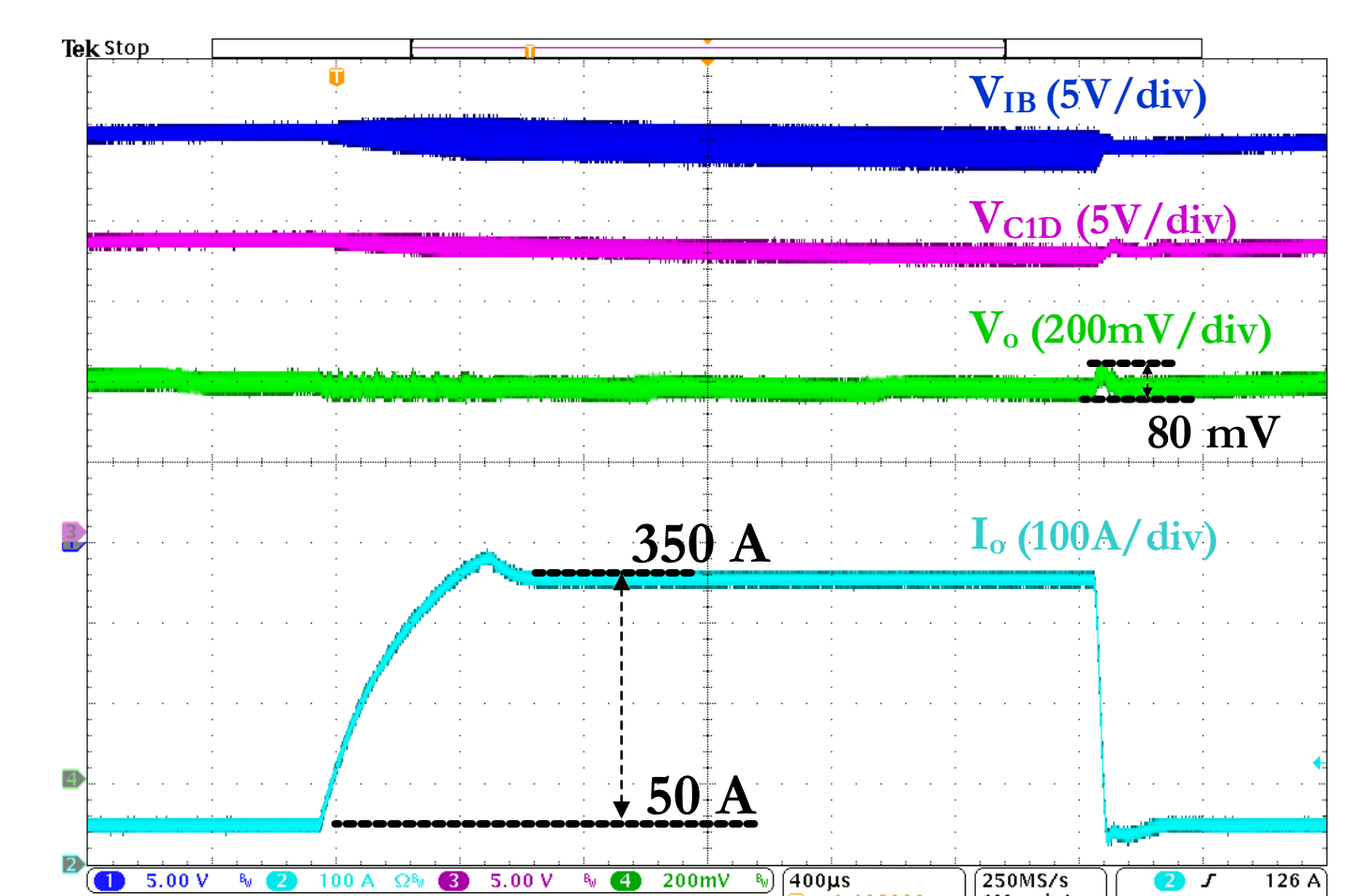
- 48 V-24 V charge pump, efficiency > 99%
- 24 V-1 V series-cap buck, equivalent to 6 V-1 V buck, lower V_{BV}
- Merged-two-stage operation with small bus capacitor (C_{IB})



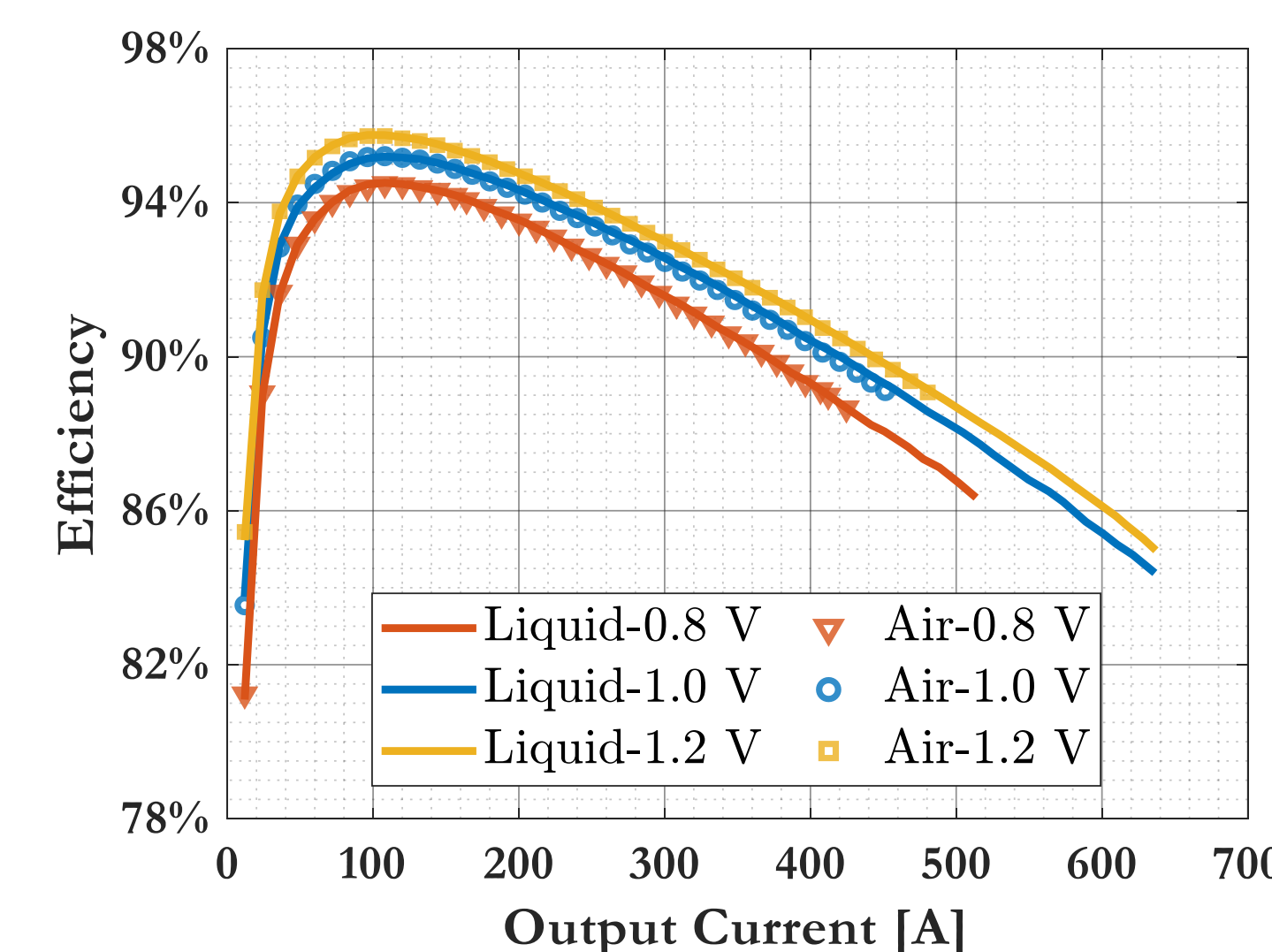
EXPERIMENTAL RESULTS



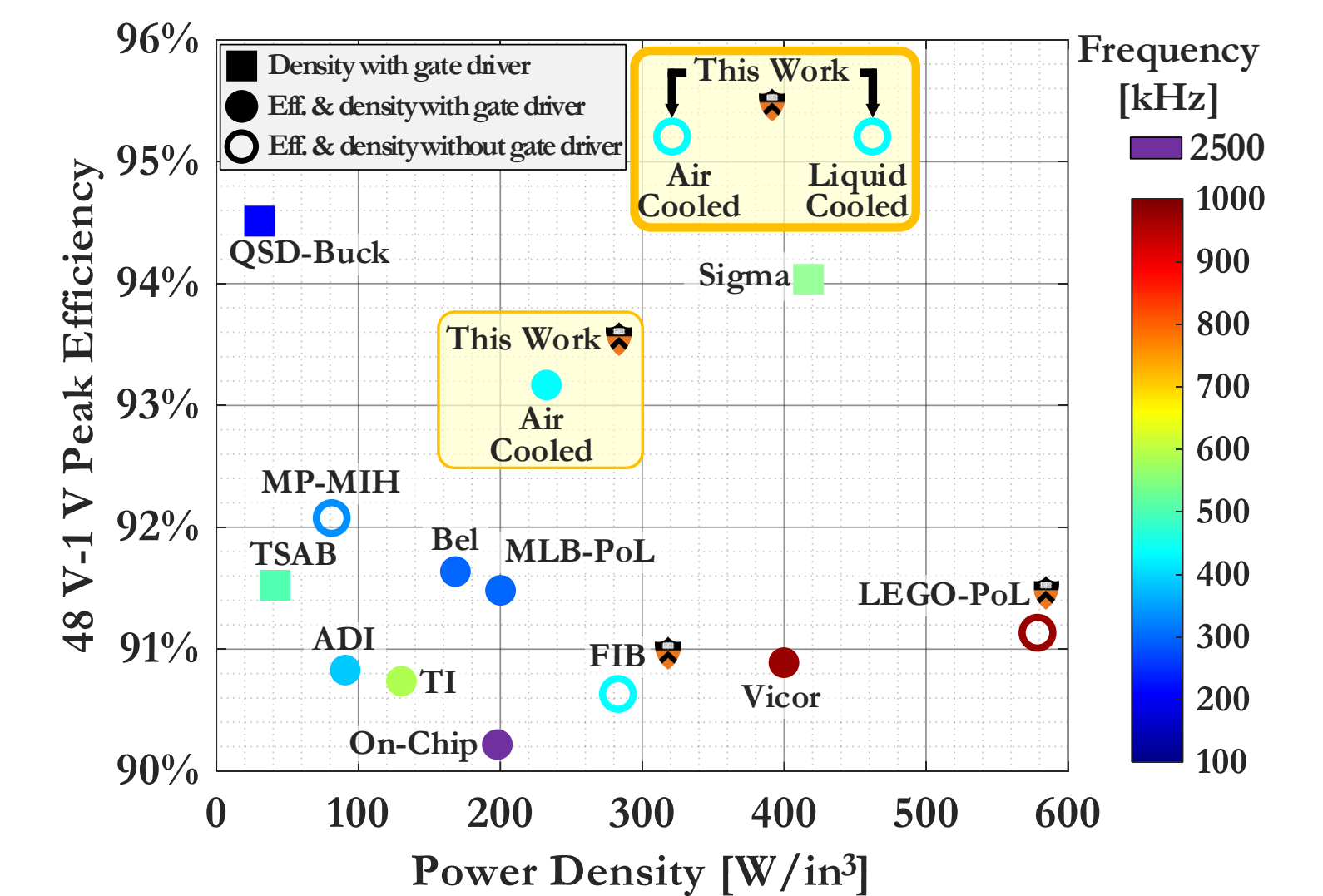
Drain-source voltage waveforms of the switches.



Close loop output current transient from 50 A to 350 A



Measured efficiency of the VIB-PoL prototype at different output voltages.



Peak efficiency and power density comparison of the 48V-1 V designs

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