SOLUTION BRIEF

±400 V HV hot-swap reference design for next-gen 400 V/800 V AI server architectures

REF_800V_LS_HSC_2WIRE

As AI-optimized accelerators like GPUs and TPUs scale exponentially, their power demands have shattered the limits of conventional delivery architectures, precipitating a critical “density wall”. High-voltage direct current (HVDC) power distribution is the direction that the industry is adopting to satisfy the high-power needs for upcoming AI datacenters. With this transition to HV busbars, the hot swap circuitry moves from a LVDC (54V) rail to a HVDC (400 V to 800 V) busbar, introducing the need for a HV hot swap solution. This solution brief introduces a novel high-voltage hot-swap design, featuring fast pre-charging capability and high dV/dt ruggedness during hot-plug events, as well as advanced protection and real-time telemetry features.

The REF_800V_LS_HSC_2WIRE reference board features the XDP701-2 hot-swap controller and CoolSiC™ JFET technology, providing a robust and reliable solution for protecting systems against power-related failures.
The XDP701-2 hot-swap controller is a key component in AI data center power delivery systems, protecting against inrush current and other power-related failures such as over/under voltage, over current scenarios and over temperature.
The XDP™ controller works in conjunction with the 1200 V-rated CoolSiC™ JFET technology, which supports inrush current control and pre-charging of large input bulk capacitance enabled by its high linear mode capability. This technology provides a good balance of R_{DSon}*A figure of merit and robustness, making it a perfect fit for HV hot-swap applications. The CoolSiC™ JFET is operated in a cascode configuration together with an OptiMOS™ LV MOSFET, hence resulting in a normally-off behavior, that can be driven as any other silicon MOSFET device.

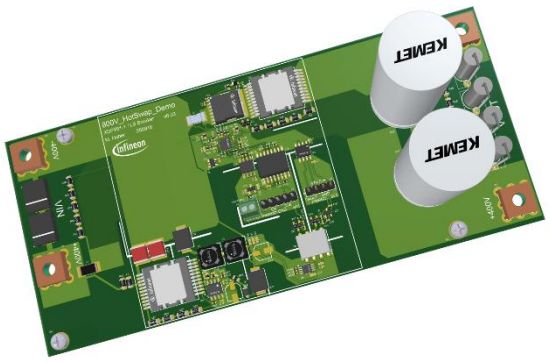
The reference design also provides a solution for HV auxiliary supply, allowing to power all peripheral components and the communication interface from the HV DC input rail.

Key features

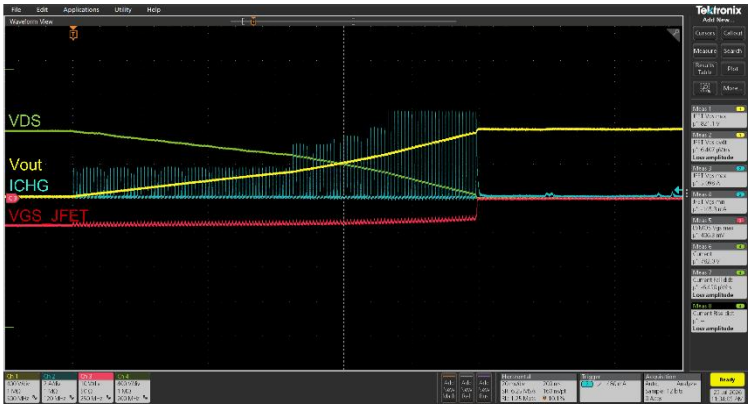
- Wide operating supply voltage range of 200 VDC to 800 VDC
- Up to 22 kW of output power delivery, achieved by super low-ohmic 1200 V CoolSiC™ JFET
- Pre-charge up to 300 µF of input bulk capacitance in less than 2 seconds
- Closed-loop SOA control of JFET, allowing the power system to operate under safe conditions

Key benefits

- Real-time telemetry via PMBus v1.3
- Wide range of programmable protection features (see XDP701-x datasheet)
- Boost mode for enhanced modes of pre-charging
- Avalanche rugged and high inductive clamping capability

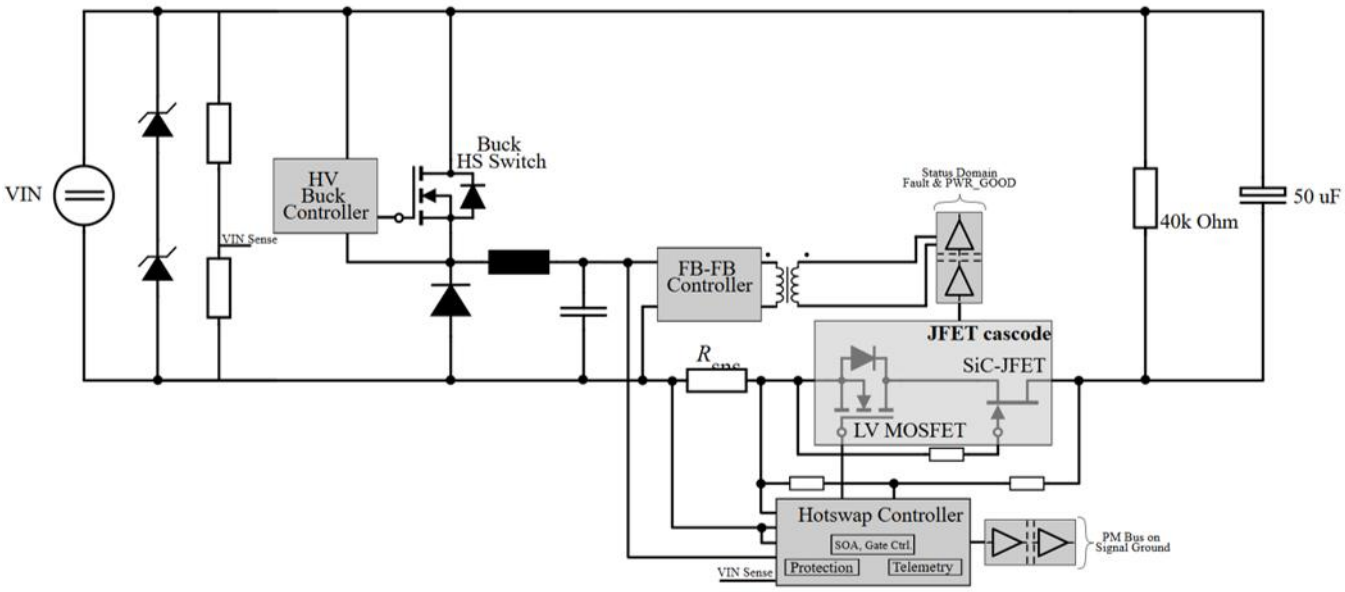


REF_800V_LS_HSC_2WIRE



Pre-charging waveforms

HV hot swap block diagram



Highlighted key products

No.	Product Group	Part Number	Description
1	CoolSiC™ JFET	IJCQ120RM61J1	1200 V CoolSiC™ JFET, $R_{DS(on)}$=6.1mΩ
2	OptiMOS™ MOSFET	IPT004N03L	OptiMOS™ MOSFET 30 V, $R_{DS(on)}$=0.4mΩ
3	XDP™	XDP701-002	Digital hot swap controller
4	CoolSET™	ICE5GSAG	PWM controller
5	CoolSiC™ MOSFET	IMCQ120R078M2H	1200 V CoolSiC™ JFET, $R_{DS(on)}$=78mΩ

Published by
Infineon Technologies AG
Am Campeon 1-15, 85579 Neubiberg
Germany

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Public

Version: V1.0_EN
Date: 11/2026

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