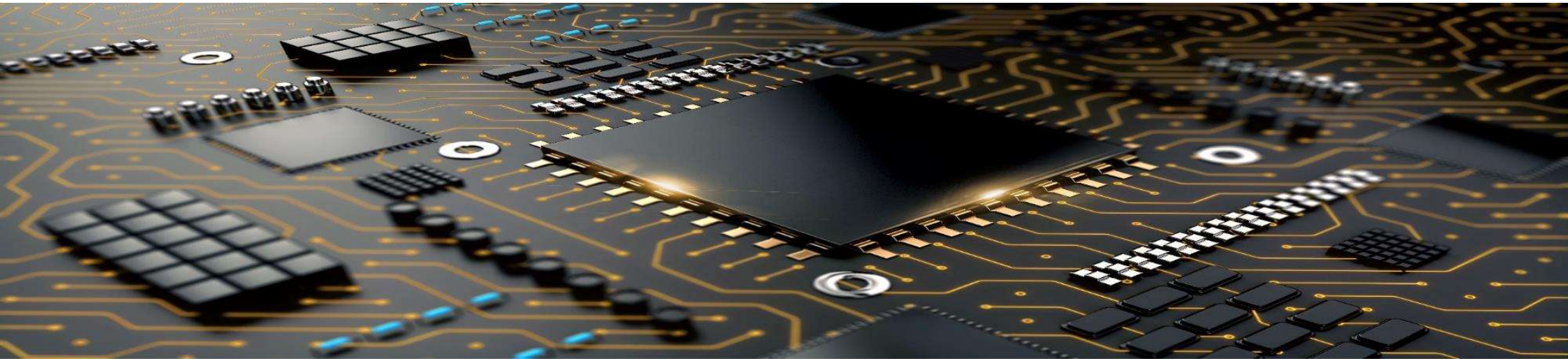


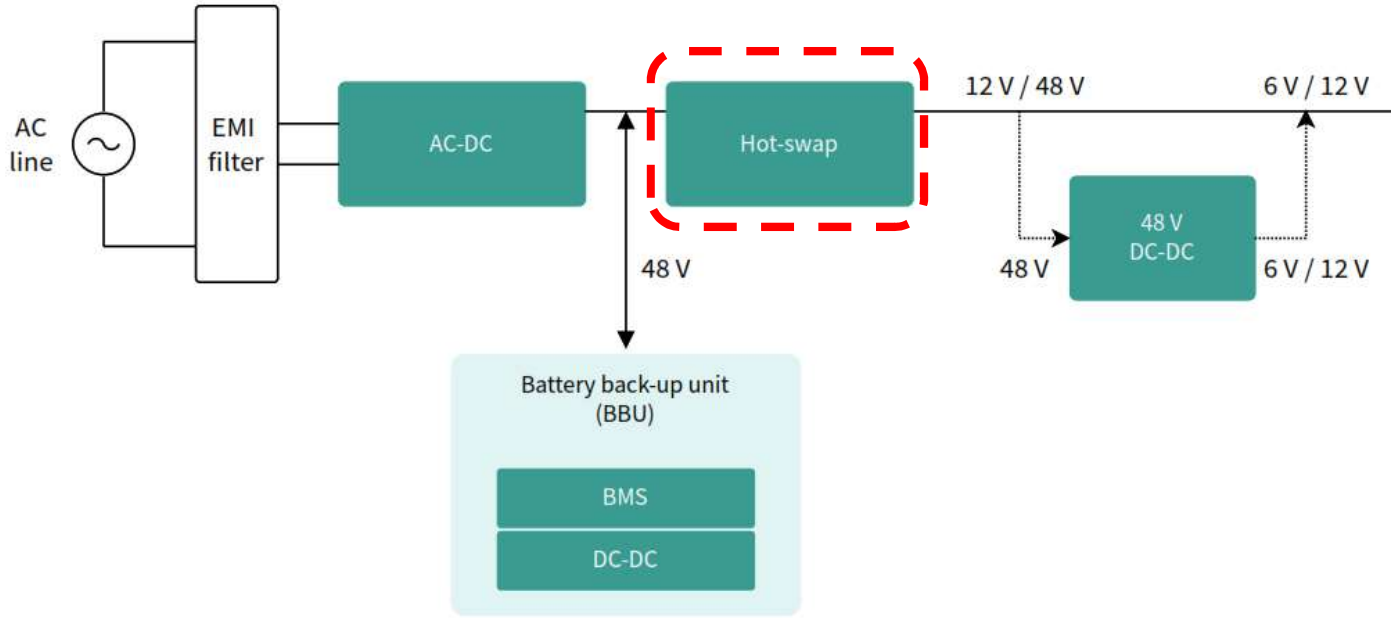
48V to 12V Hot Swap Solution | 2025

Applications & Solutions

ALPINESEMI®

Background of 48V to 12V Hot Swap

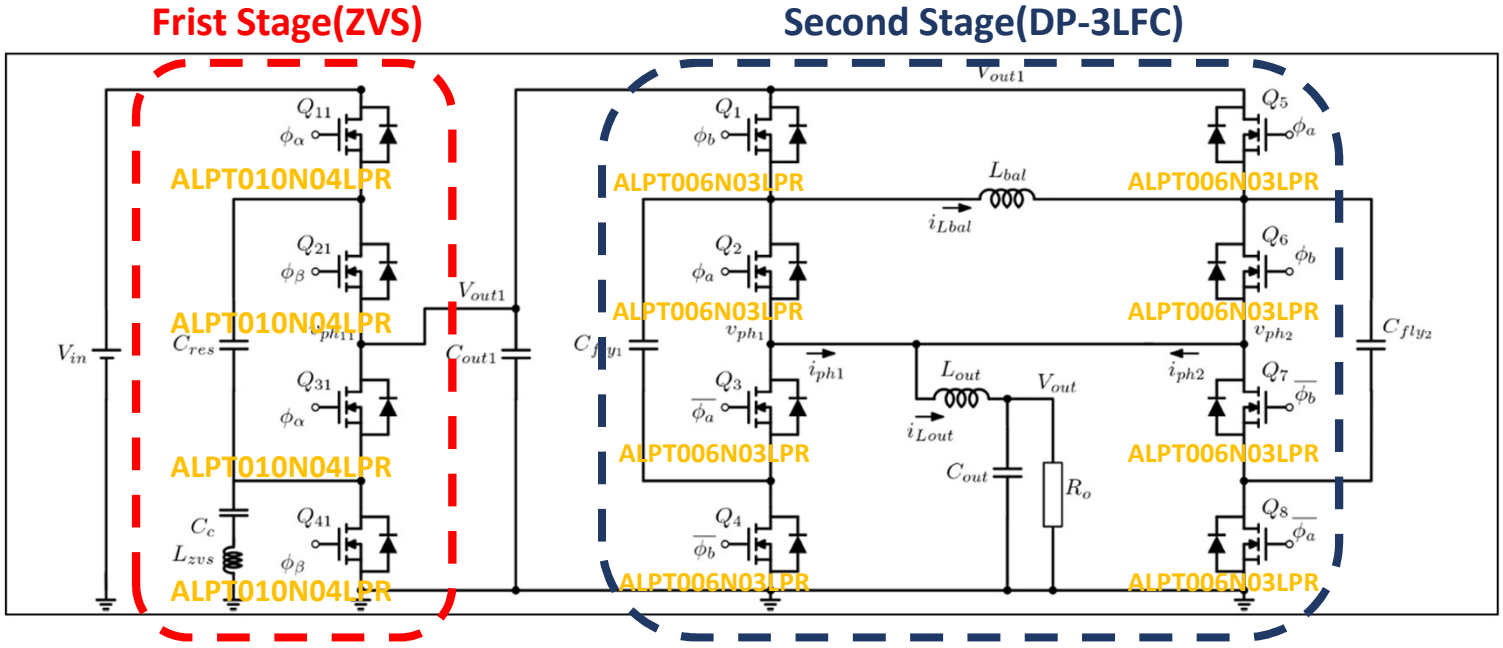
The rapidly increasing electricity consumption of modern data centers demands a continuous improvement at system and converter levels. In an attempt to reduce the conduction losses in DC bus distribution, recently, a 48 V has been proposed to replace the existing 12 V bus voltage. To adapt the existing 12 V infrastructure to 48 V, a DC-DC converter can provide the interface between the 48 V bus and the regulated 12 V rail. One of the biggest challenges in enabling artificial intelligence (AI) is designing a high-power density power architecture from 48 V bus voltage. In transformer-based converters, such as LLC and PSFB, the transformer also has a fixed core loss over the entire load range, limiting light-load and peak efficiency.



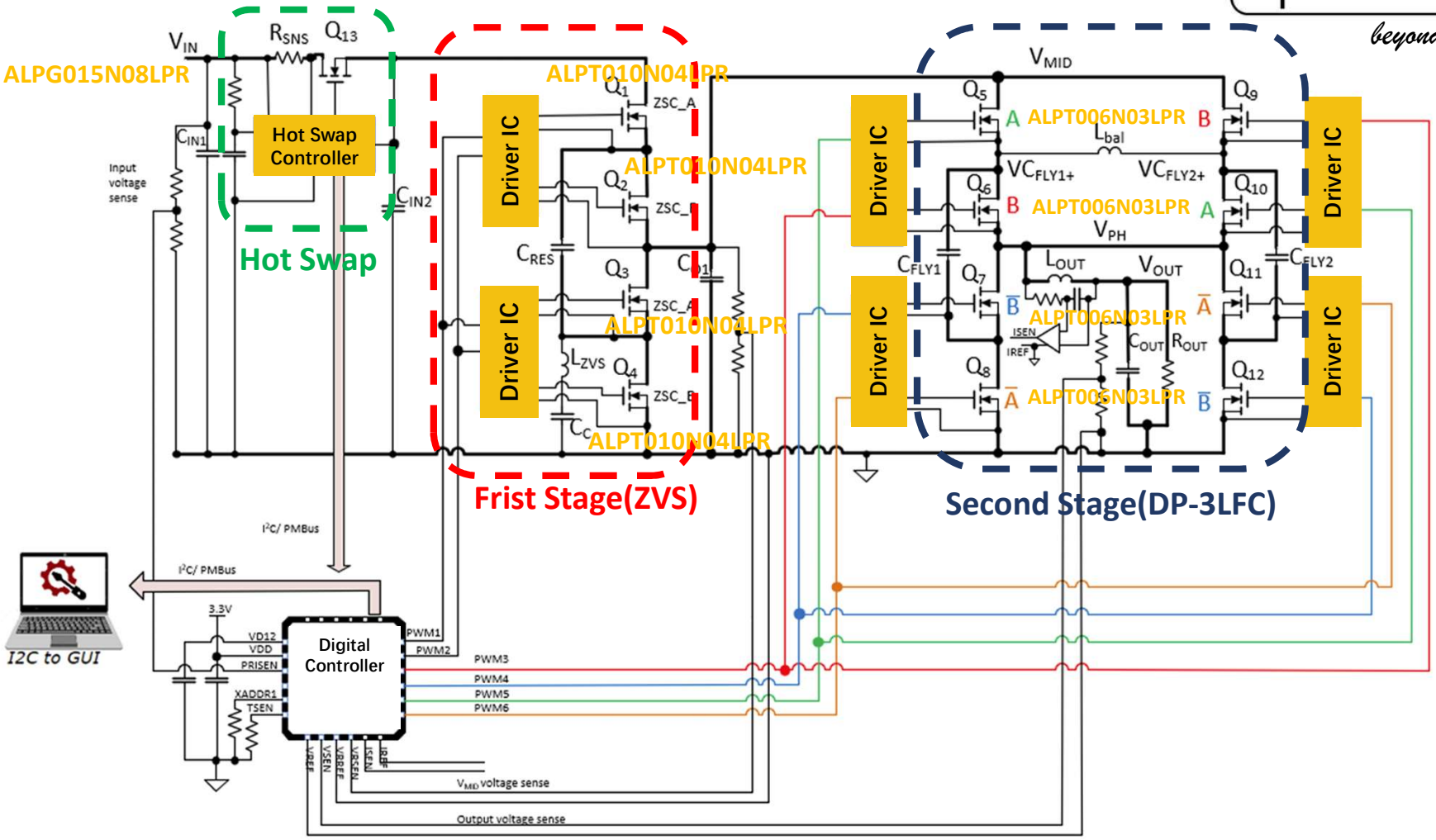
Introduction the Design Solution for 48V to 12V Hot Swap

If isolation is not required, an HOT SWAP composed of a 2:1 SC divider and regulated 2-phase, 3-level buck converter including a balancing inductor (to balance the flying capacitors of the 3-level buck stage) is proposed. The HOT SWAP converter is a novel two-stage approach where,

- The first stage is a zero voltage switching (ZVS) SC converter called ZSC convertor,
- The second stage is a dual-phase three-level flying capacitor (DP-3LFC) converter featuring an intrinsic flying capacitor balancing.



Design Solution for 48V to 12V Hot Swap



Golden Part Number of Hot Swap Solution

ALPINESEMI	Product Family	PCB Layout Qty	Remark
ALPT006N03LPR	Super Trench	Second Stage(DP-3LFC) · 8pcs	N-Channel MOSFET, BVds 25V, 0.6mΩ@10V, LFPAK56 package
ALPT010N04LPR	Super Trench	Frist Stage(ZVS) · 4pcs	N-Channel MOSFET, BVds 40V, 1.0mΩ@10V, LFPAK56 package
ALPG015N08LPR or ALPG009N08TR	Split Gate Trench	Hot Swap · 1pcs	N-Channel MOSFET, 80V, 1.5mΩ@10V, LFPAK56, /N-Channel MOSFET, 80V, 0.9mΩ@10V, TOLL package

Note: Hot Swap Controller IC and Half bridge Driver IC will be release soon