Multiport Ac-Coupled (MAC) Differential Power Processing

- 10-Port MAC DPP Converter Circuit Topology
- Communication Infrastructure
- Multi-Winding Transformer
- Experiment Results

DC Bus

• A 50V to 5V solution with 10 series voltage domains:
  - Differential power processing (DPP) for extreme efficiency
  - Multi-port ac-coupled (MAC) converter

HDD Storage Server

Overall DPP Architecture for HDD Storage Server

- Stacked 5.1inch HDDs are grouped into 10 series voltage domains:
- Each domain supplies 25W peak power (5 HDDs)
- Support "hot-swap" of an entire domain (30W differential power)

Motivation

Power Delivery Architecture in Data Center

A 50V to 3V solution with 10 series-stacked voltage domains:
- Series-stacked architecture which can step down voltage by nature and support a large number of loads
- Differential power processing (DPP) for extreme efficiency
- Multi-port ac-coupled (MAC) converter

Multiport Ac-Coupled (MAC) Differential Power Processing

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- Single magnetic core
- 99.7% peak efficiency

A Three Layer Solution with SATA Extension Boards

- High Speed Differential SATA Signal
- MAC DPP Prototype (100 Win³ Power Density)

Supplying 300W with a smartphone size

- ~10x lower loss
- ~3x higher density
- ~10x lower cost
- Read, write, hot swap

Experiment Results

- Prototype Overview
- Thermal Images
- HDD Storage System Testbench

- HDDs at different voltage domains transmit information through standard SATA
- Verified reading, writing and hot-swap
- MAC DPP Converter
- TOP COVERS
- BOTTOM COVER
- Power Board
- Simplified Modular Layer Model
- FEM

- System Efficiency

η = Power Consumed by HDD

- Peak efficiency: 99.7%
- Efficiency: ~99% for differential power ratio

References
