

800V Data Center DC/DC Design Considerations, Topology Comparisons, and Trade-offs

David Reusch

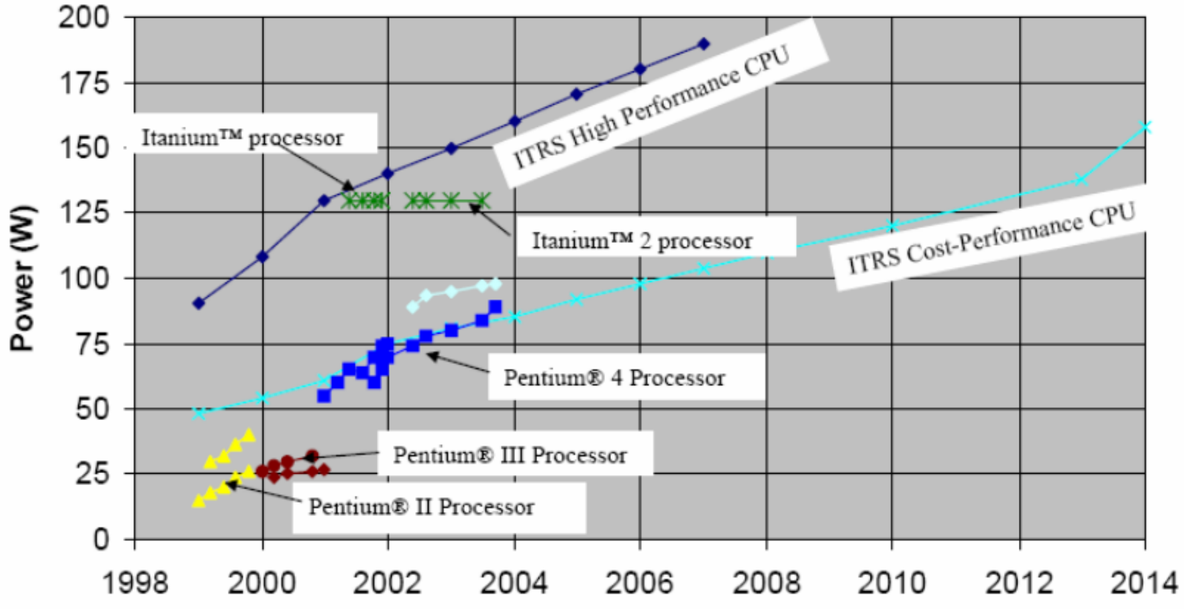
Texas Instruments, Data Center Systems Engineer

Texas Instruments

Evolving Data Center Power Demands

"The computer has seen exponential growth in performance and the power requirements have increased…
these demands are expected to continue"

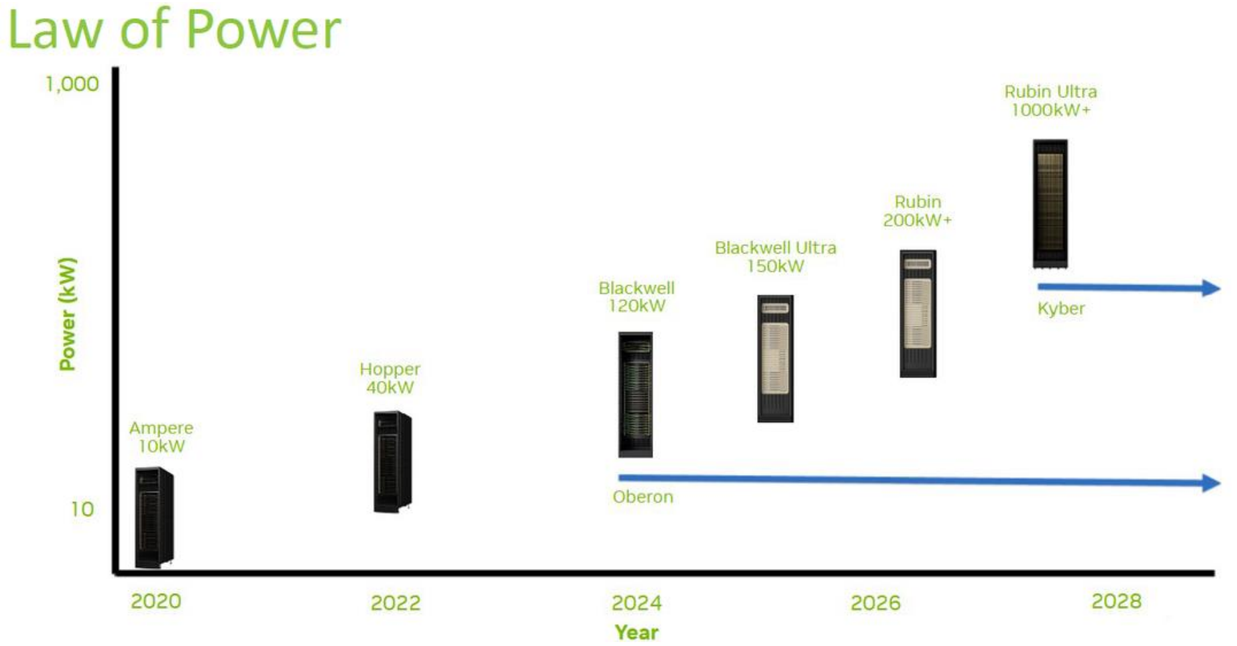
2006, David Reusch, MS Thesis



Source: Ed Stanford, "New processors will require new powering technologies," Magazine of Power Electronics Technology, Feb. 2002, pp. 32-42

20 years:

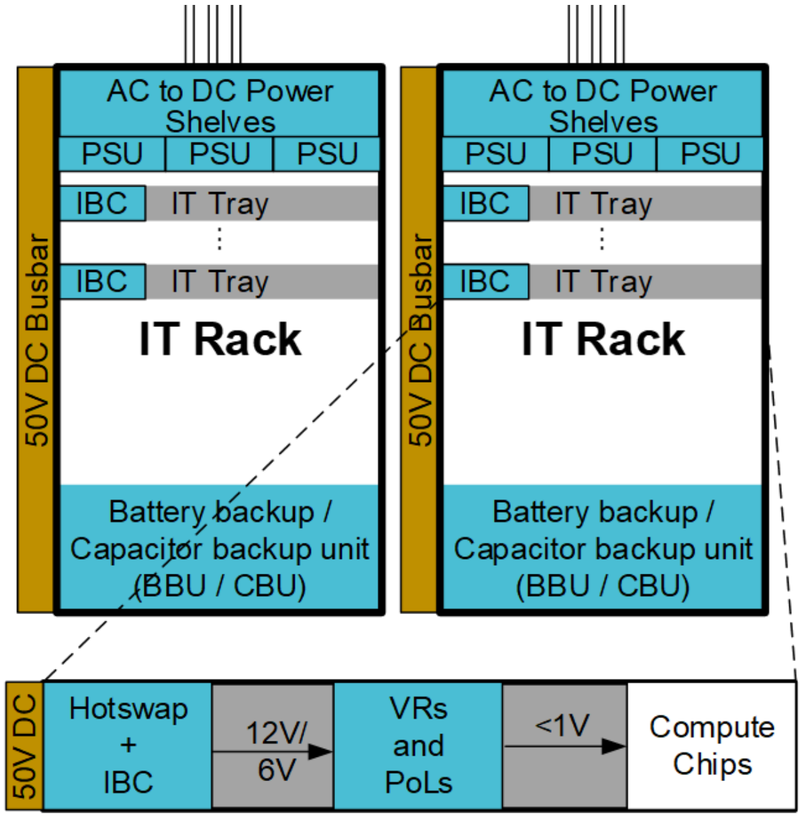
~200W per processor ⟶ **~2000W** per processor



Source: OCP Global Summit 2025 "800VDC MGX Accelerated Computing Rack & Energy Storage for Improved GPU Power Utilization" Jared Huntington and Mike Tu, NVIDIA

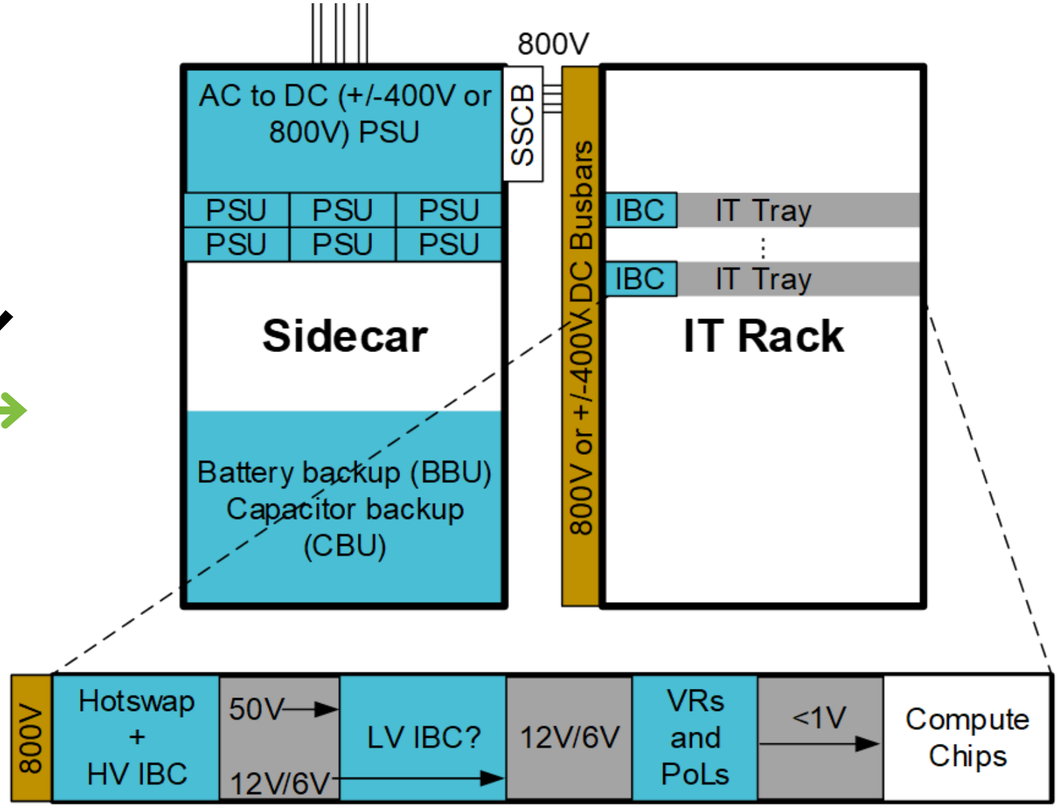
Evolving Power Distribution Methods

50V Busbar Rack

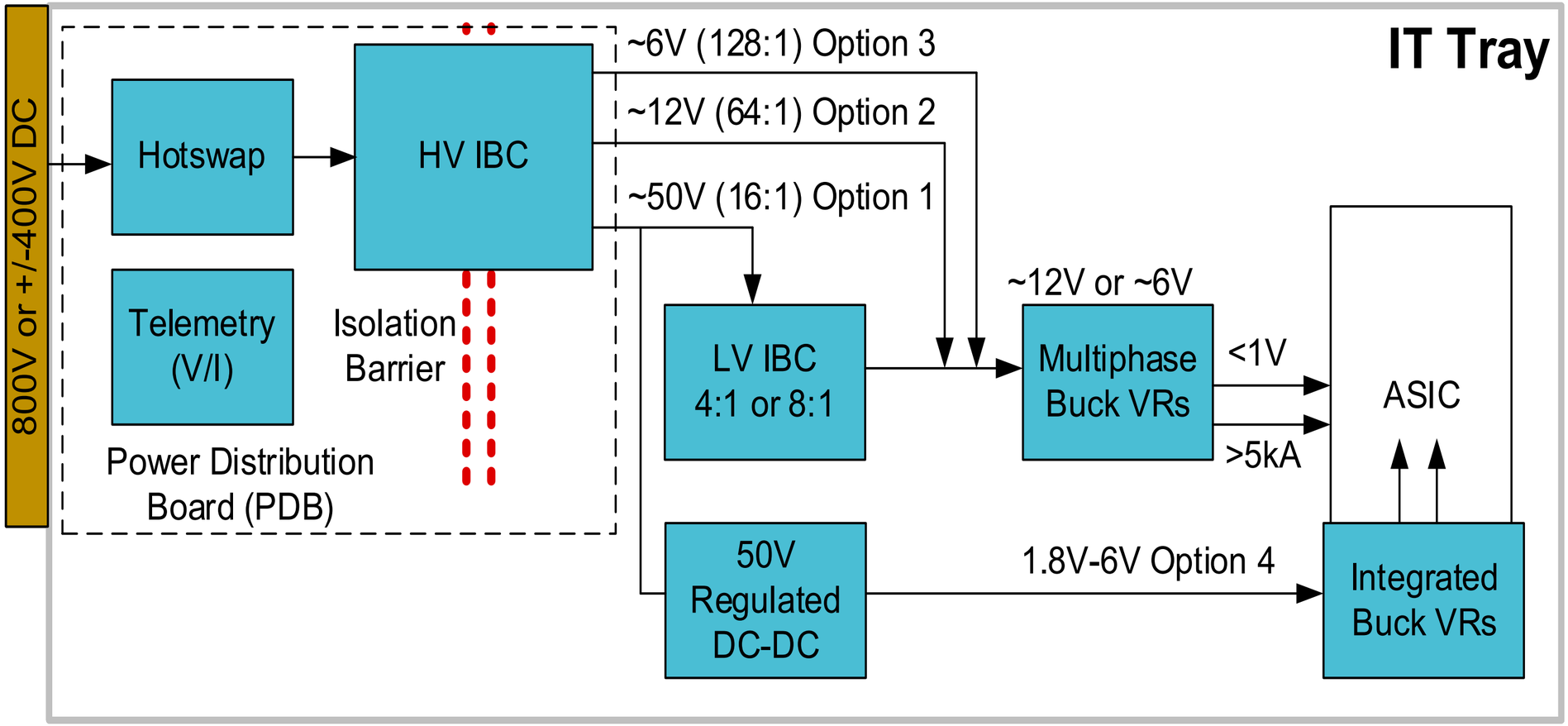


V↑ I↓

800V Busbar Rack

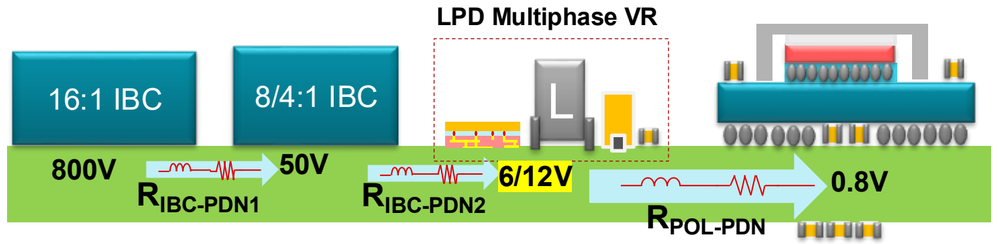


The Best Way To Get From 800VDC to >1V

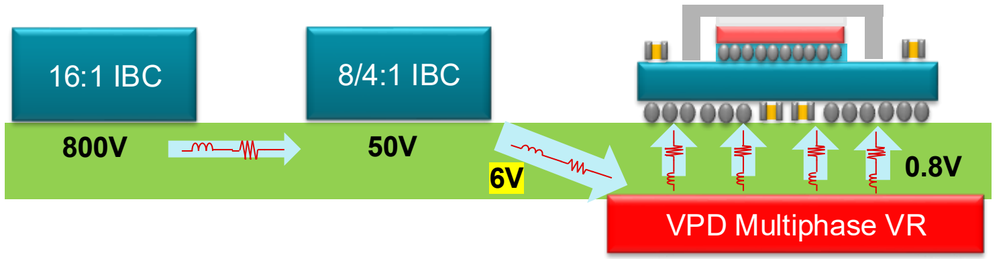


Evolving Power Distribution Networks

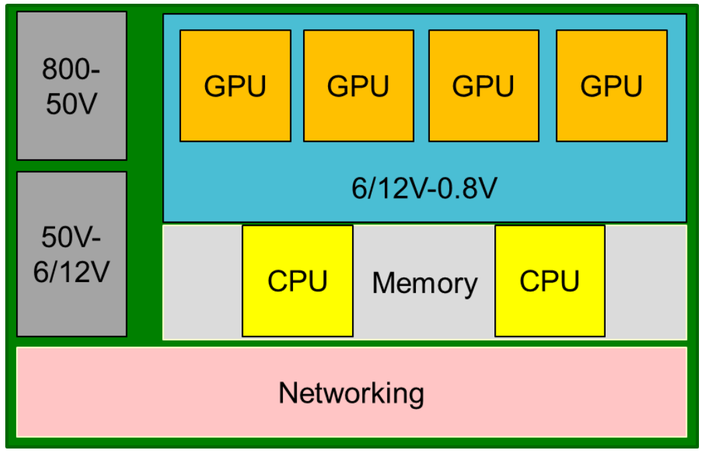
Lateral Power Delivery (LPD) Approach



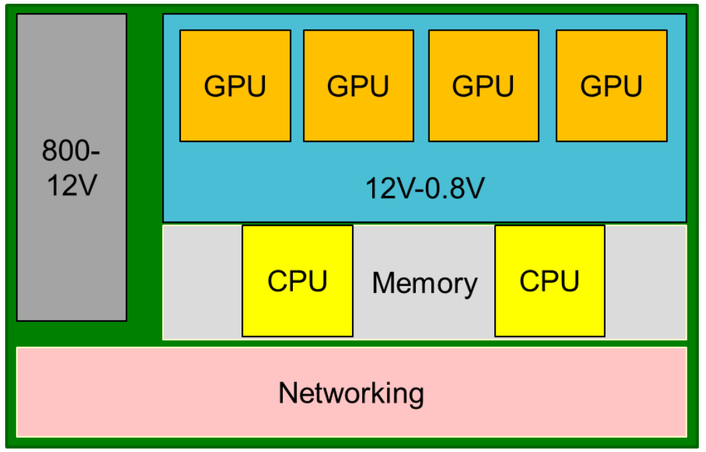
Vertical Power Delivery (VPD) Approach



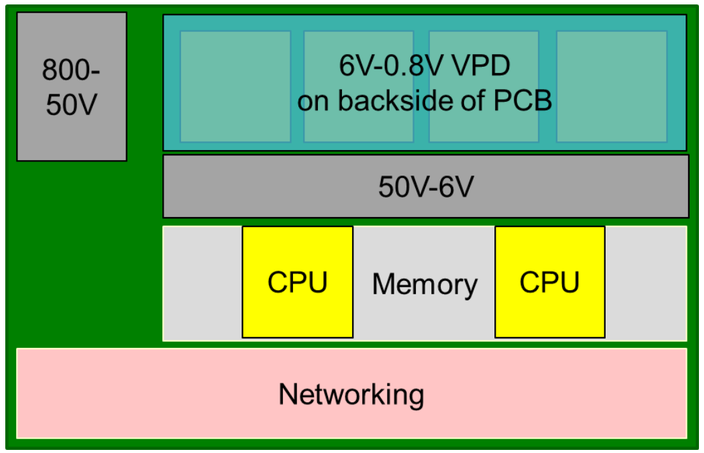
Option 1 LPD



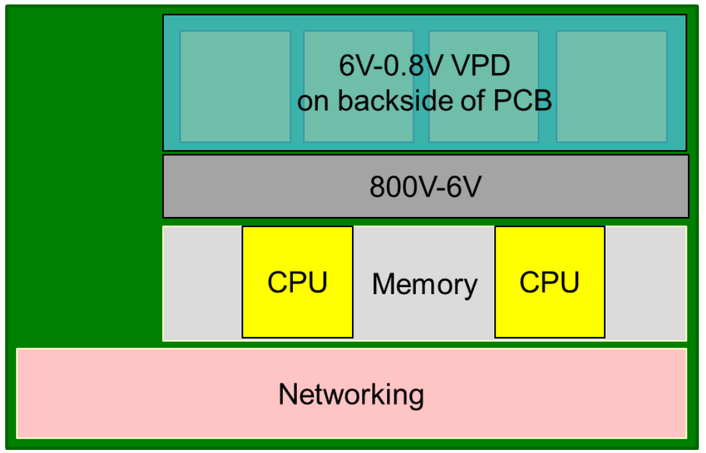
Option 2 LPD



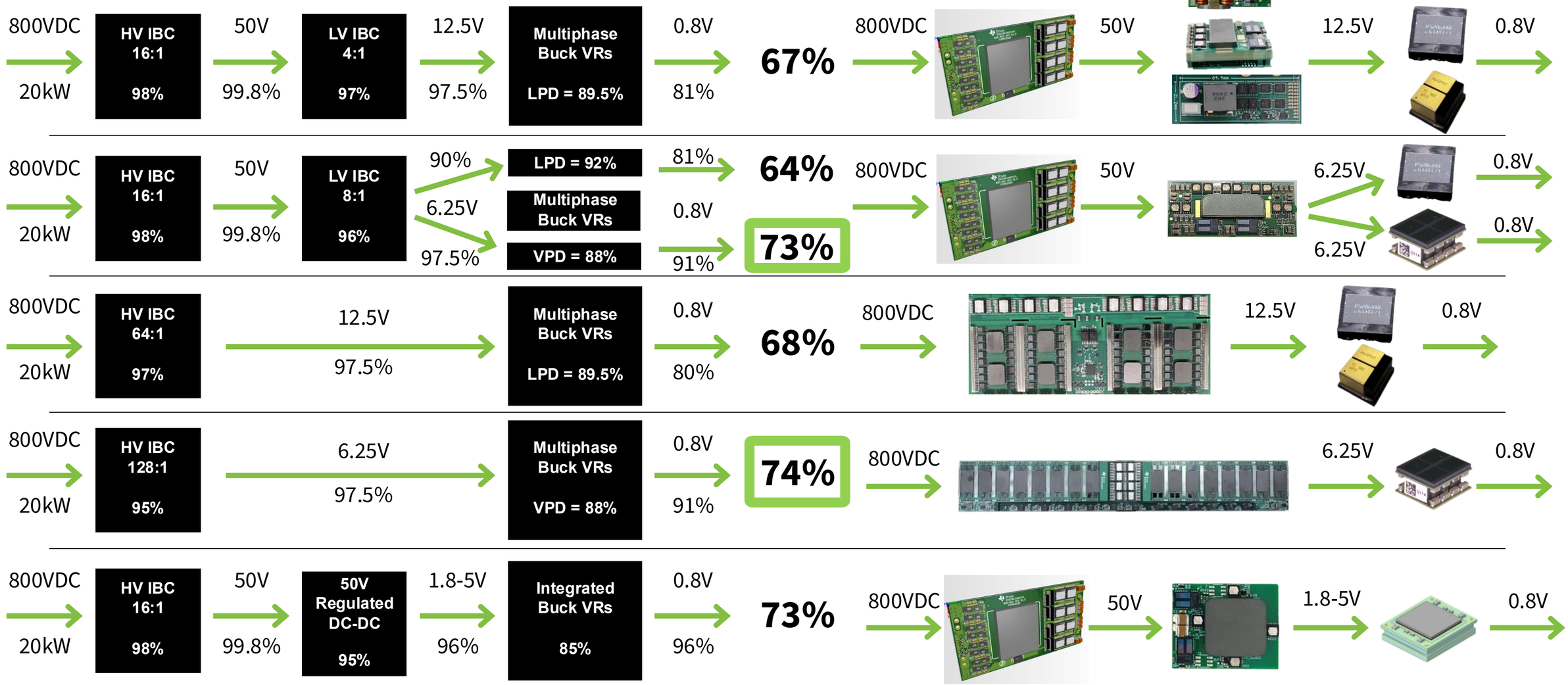
Option 1 VPD



Option 3 VPD



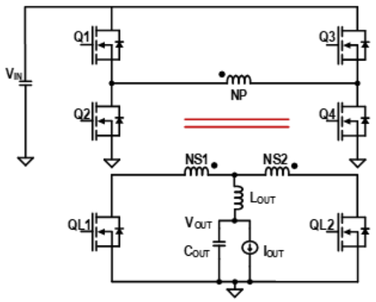
Comparing 800V Architectures



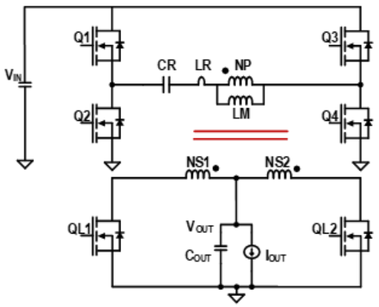
Topologies

50V

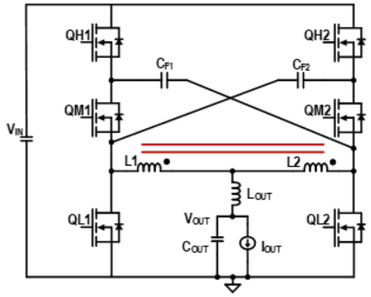
Full Bridge (FB)



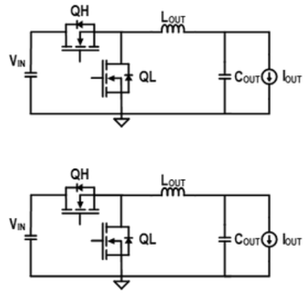
LLC



Hybrid Switched Capacitor (HSC)



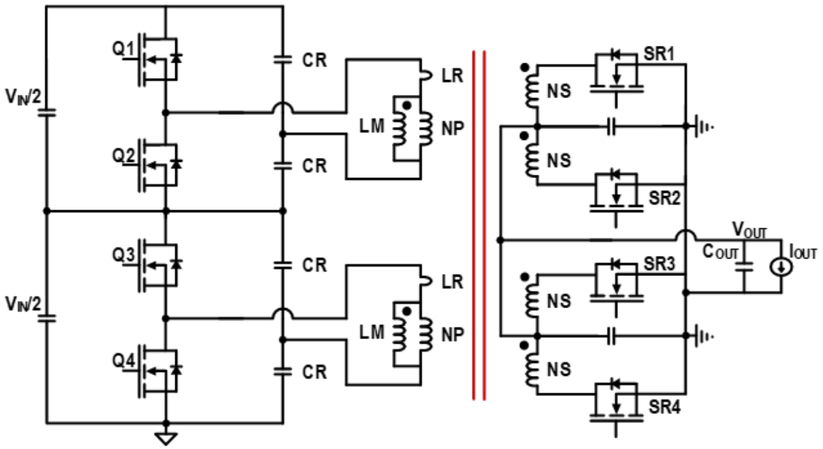
Buck



	FB	LLC	HSC	Buck
Module or chip-down	Module	Module	Both	Both
Regulation	Fully regulated	Unregulated	Semi-regulated	Fully regulated
Efficiency	Medium	High	High	Medium/Low
Power density	Medium	High	Medium	Low
Output voltage scalability	High	High	Low	Medium
Complexity	Medium	High	High	Medium/Low

800V

Stacked LLC

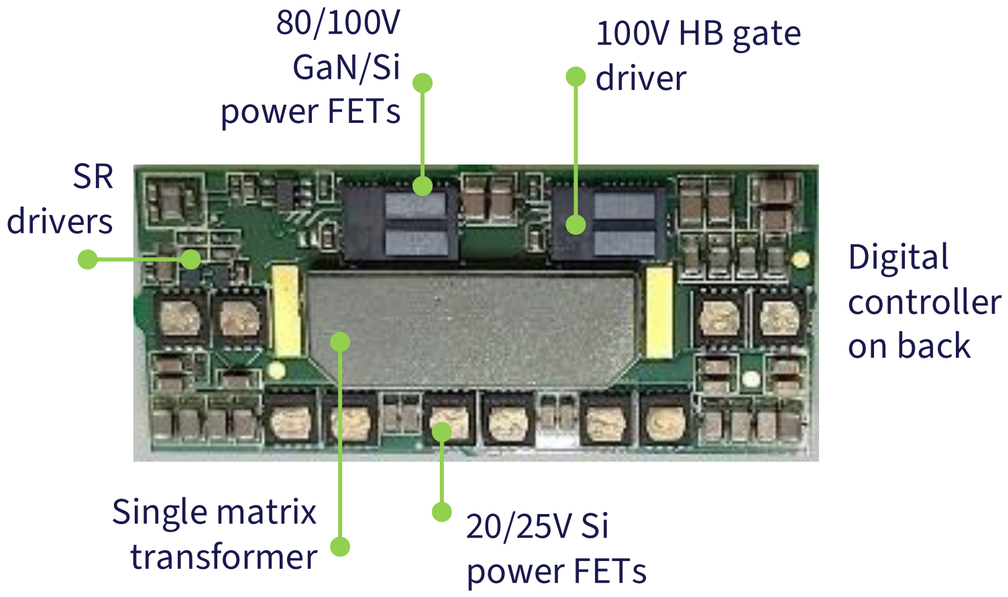


HVDC requires isolation, increased clearance, soft-switching, high current rectifiers

50V And 800V LLC Designs

$50V_{IN}$-$6V_{OUT}$ LLC

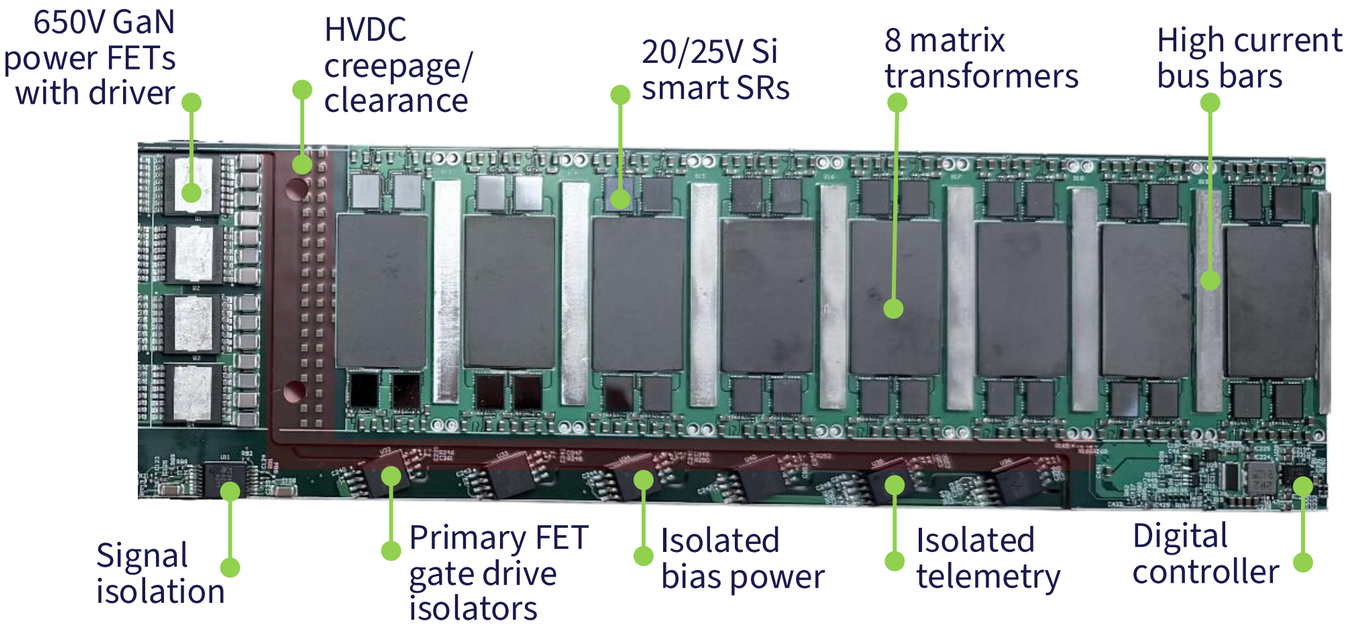
750-1000W per module
~96-97% full load efficiency
~2000W/in³ power density



$800V_{IN}$-$6V_{OUT}$ Stacked LLC

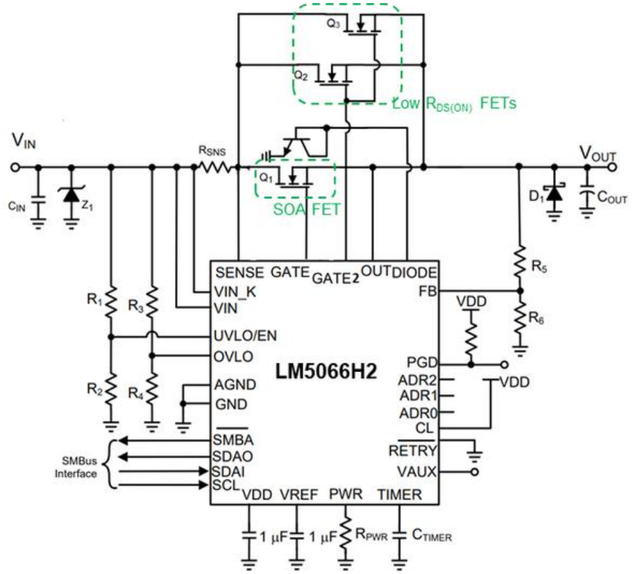
10,000W per module
~94-96% full load efficiency
~2000W/in³ power density

Thank you:
Rimon Gadelrab and TI HVDC design team



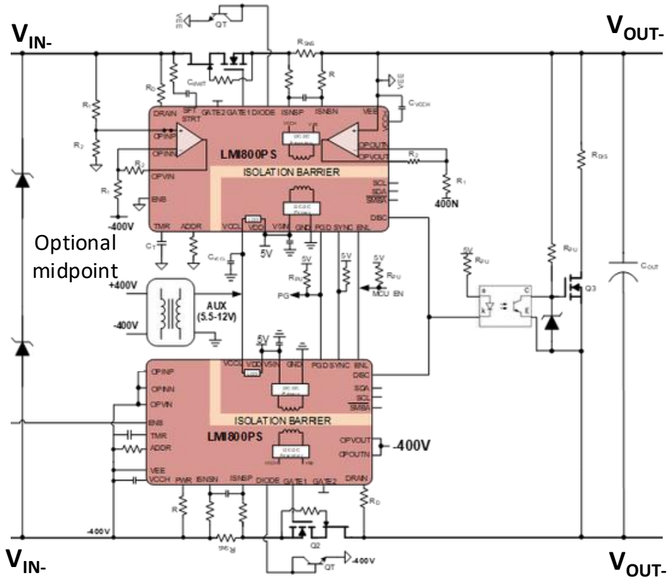
Protection

50V



- Single side protection
- 80V/100V power FETs
- No isolation barriers

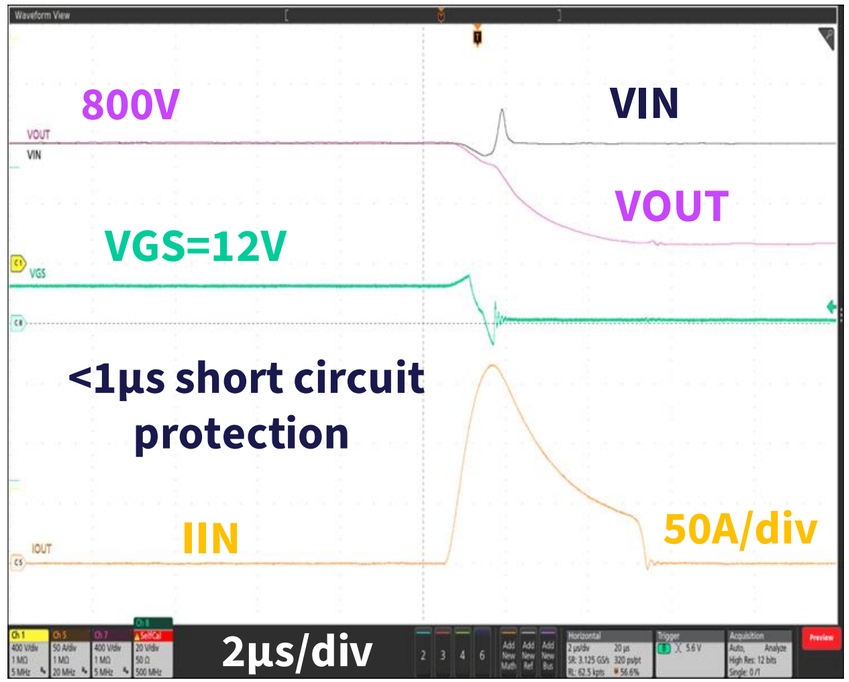
800V



- Double sided protection (+/-400V)
- SiC power FETs
- HSC HS/LS coordination
- Integrated isolated bias supply
- Integrated isolation for digital telementry and control

VIN=800V
Hard output short-circuit

Thank you:
TI Power Protection Devices design team



Summary And Call to Action

- HVDC is enabling the next generation of server power demands
- Best way to get from 800VDC to >1V is not a simple question
  One clear winner: Vertical Power Delivery (VPD)
- GaN and SiC power devices are enabling technologies for HVDC
- Unsung heroes of HVDC include isolated protection, bias supplies, gate drivers, and telemetry

OCP-driven HVDC standards eliminate custom engineering and shorten supplier time-to-market.

- **Creepages and clearances**
- **DC-DC converter dimensions**
- **Protection requirements**

Thank You!

Any questions?

